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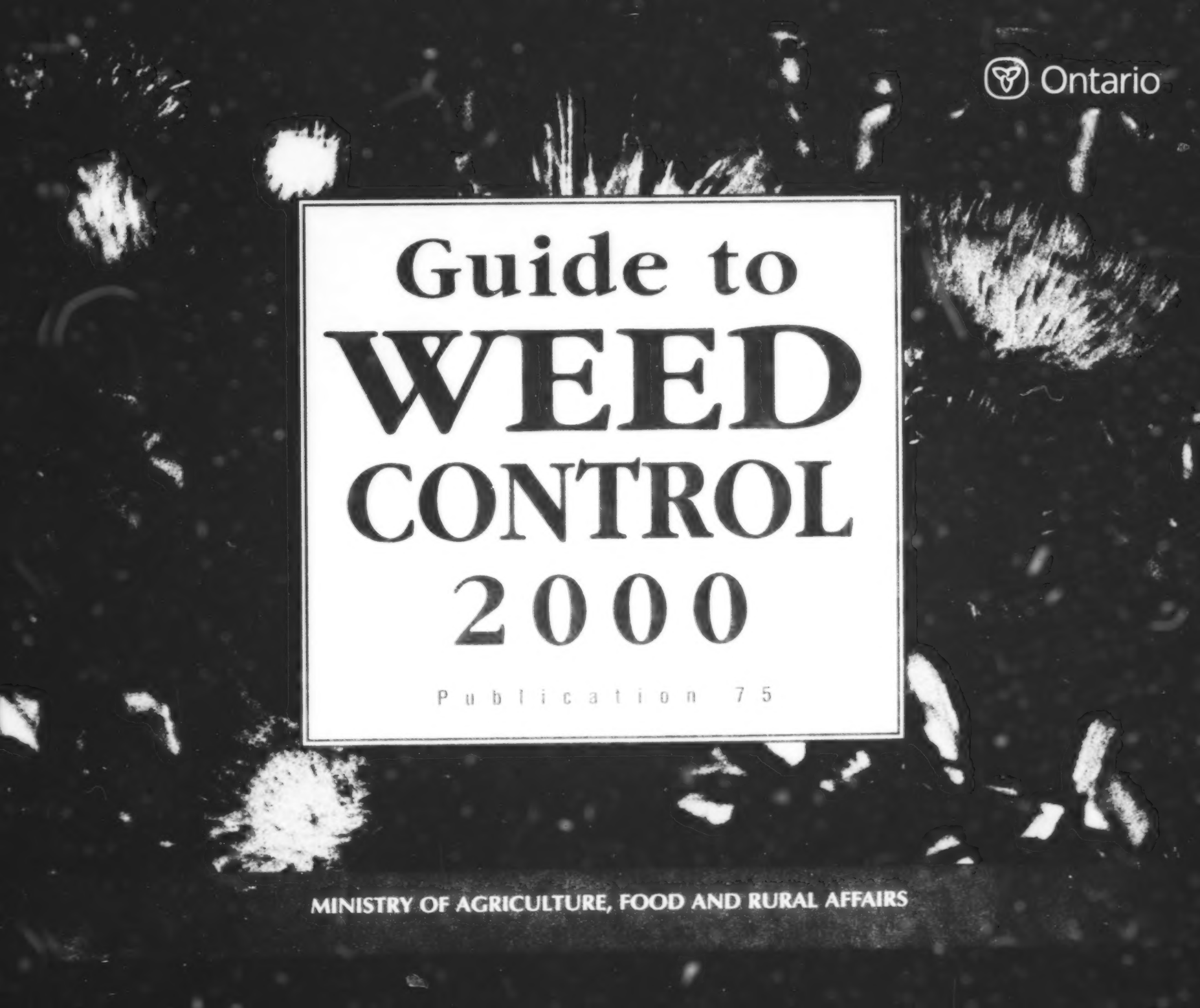

Ontario

Guide to WEED CONTROL 2000

Publication 75

MINISTRY OF AGRICULTURE, FOOD AND RURAL AFFAIRS

Prepared by

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About This Guide

Guide to Weed Control (Publication 75) is a publication of the Ontario Ministry of Agriculture, Food and Rural Affairs. It is written under the guidance of the Ontario Weeds Committee. Users are encouraged to look at the various sections to find information on each product. *Table 1, Herbicides Used in Ontario,* has basic product information and *Notes on Chemicals* details the general use of each product. Each crop section has detailed instructions on rates and effectiveness against various weed species. There are sections on pesticide safety and use. Please read the product label for more information.

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Weed Control Glossary

100-03352/

(Also see Notes on Chemicals)

Acid Equivalent (abbreviation - a.e.) (2,4-D, glyphosate) — the active part of the acid herbicide being used — usually indicated in grams/L on the label.

Active Ingredient — the chemical in a formulated product that is responsible for the herbicide effects.

Adjuvant — an ingredient added to a herbicide formulation or spray mixture to aid or modify the action of the herbicide, or the physical characteristics of the mixture.

Amine — acid or anionic herbicides can be formulated as ammonium salts or amines. 2,4-D amines are relatively non-volatile under most climatic conditions.

Annual Plant — completes its life cycle within a one year period.. Summer annuals complete their life cycle between spring and fall. Winter annuals germinate in fall, overwinter and then flower and complete their life cycle the following spring or summer.

Band Treatment — a herbicide applied as a narrow strip over the crop row, usually followed by inter-row cultivation.

Biennial Plant — completes its life cycle within a two-year period. Germinates in the spring, overwinters, flowers the following spring or summer and dies back the following fall.

Carrier — the diluent or material added to a herbicide product to facilitate its even distribution over the target area. The carrier is often water but it may also be granular products, oil or other solvents.

Compatible — compounds or formulations that can be mixed and applied together without undesirably altering their separate effects effects or the physical properties of the mixture.

Contact Chemicals — chemicals that kill only the parts of the plant on which they are sprayed. Movement within the plant is minimal.

Cotyledons — the seed leaves. Often visible when large seeds are opened. These are the first leaves visible in the germinated seedling. Broad-leaved crops or weeds have two cotyledons(dicots). Grasses (monocots) have one.

Directed Treatment — a treatment directed onto the weeds or soil in such a manner as to avoid contact with the crop.

Dormant — a resting stage similar to the condition of a plant during the winter.

Emergence — the time at which the seedling first appears above the ground.

Escape — a plant in a treated area that has been missed or survived the treatment.

Ester — Some acid herbicides are reacted with alcohols to produce ester formulations. Ester formulations of 2,4-D and related herbicides can vaporize under hot conditions after treatment and cause unwanted damage by moving away from the treated area.

Formulation — means the same as **Product** — an active ingredient processed with other materials or formulants to make it easier to apply and/or more effective. Herbicides are rarely sold as pure active ingredients(2,4-D acid), they are sold as formulated mixtures(i.e. 2,4-D amine, sodium salt or ester with added emulsifiers, adjuvants, carriers, etc.).

Half-life — the time required for 50% of a herbicide to be degraded or inactivated in soil or water.

Herbicide — a chemical that is toxic to plants.

Herbicide Tolerant Crops (abbreviation - HTCs) — New varieties of crops that have been developed by classical breeding or transgenic techniques to be tolerant to specific herbicides

Hormone-Type Herbicide — includes 2,4-D, 2,4-DB, mecoprop MCPA, MCPB, dichlorprop, dicamba and triclopyr, picloram. At extremely low concentrations, these chemicals can stimulate and/or disrupt the growth of broadleaved plants.

Non-Selective Herbicide — a chemical used in such a manner that all exposed vegetation is damaged.

Perennial Plant — lives for more than 2 years.

Product — the contents of a herbicide container as marketed. In addition to the active ingredient, it may also contain other solvents, surfactants or carriers that are referred to as inert ingredients or formulants.

Program — application of one or more herbicides at two different stages of crop and/or weed growth. The second herbicide application is used to provide control of the weeds either escaping the original herbicide treatment or that are problems at different periods in the growth of the crop.

Resistant Weeds (Herbicide Resistant Weeds) — the inherited ability of some weeds in the population of a particular weed species to survive a herbicide application to which most of the original population was susceptible.

Selective Herbicide — a chemical used in such a manner that it will kill weeds on a growing crop without damaging the crop.

Sodium Salt — some acid or anionic herbicides can be formulated as sodium salts (e.g. 2,4,-D).

Soil Sterilant — a soil active herbicide that is applied at a sufficiently high rate to prevent all plant growth for at least one season

Surfactant — a chemical added to the herbicide formulation or to the spray solution to improve the dispersing, spreading, sticking or wetting properties of the spray mixture.

Susceptible — a crop that may be damaged or a weed that may be readily controlled by a recommended rate of herbicide.

Tank Mix — two chemicals that are packaged separately and mixed in the sprayer tank.

Translocated Herbicide — a chemical herbicide that moves within the plant.

Principles of Integrated Weed Management

Integrated Weed Management (IWM) uses all available weed control options in the best possible way to manage weed populations. Such options include crop rotation, cover crops, intercropping, manipulation of nitrogen fertility, planting pattern, tillage systems, critical period of weed control, alternative weed management strategies in conservation tillage systems and economic thresholds. All these practices are components of an IWM system and none of these control measures on their own can be expected to provide acceptable levels of weed control. Therefore, instead of relying on only one particular method of weed control, an IWM system uses a combination of methods to control weeds. By following the principles of an IWM system we can reduce the use of herbicides and at the same time provide optimum economic returns to the grower.

Crop rotation

Crop rotation involves alternating different crops in a systematic sequence on the same land. It is an important strategy for developing a sound long-term weed control program. Weeds tend to thrive with crops of similar growth requirements as their own and cultural practices designed to contribute to the crop may also benefit the growth and development of weeds. Monoculture, that is growing the same crop in the same field year after year, results in a build-up of weed species that are adapted to the growing conditions of the crop. When diverse crops are used in a rotation, weed germination and growth cycles are disrupted by variations in cultural practices associated with each crop (tillage, planting dates, crop competition, etc.).

Cover crops

The inclusion of cover crops such as rye, red clover, buckwheat and oilseed radish or overwintering crops like winter wheat or forages in the cropping system can suppress weed growth. Fast growing crops or crops exhibiting allelopathic properties can also suppress weeds. Highly competitive crops may be grown as short duration "smother" crops within the rotation. Additionally, cover crop residues on the soil surface will suppress weeds by shading and cooling the soil. When choosing a cover crop, consideration should always be given to how the cover crop will affect the succeeding crop.

Intercropping

Intercropping involves growing a smother crop between rows of the main crop. Intercrops are able to suppress weeds. However, the use of intercropping as a strategy for weed control should be approached carefully. The intercrops can greatly reduce the yields of the main crop if competition for water or nutrients occurs.

Nitrogen fertility

Nitrogen fertilizer can affect the competition between crops and weeds and in the subsequent crops. For example, nitrate is known to promote seed germination and seed production in some weed species. Nitrogen fertilization may result in increased weed growth instead of increased crop yield. Selective placement of nitrogen in a band can favour the crop over the weed. Use of legume residues as opposed to chemical nitrogen fertilizer to supplement nitrogen needs of the crop can enhance weed suppression. Legume residues release nitrogen slowly with less stimulation of unwanted weed growth.

Planting patterns

Crop population, spatial arrangement and the choice of cultivar (variety) can affect weed growth. For example, studies have shown that narrow row widths and a higher seeding density will reduce the biomass of later-emerging weeds by reducing the amount of light available for weeds located below the crop canopy. Similarly, fast growing cultivars can have a competitive edge over the weeds.

Tillage System

Tillage systems alter the soil seedbank dynamics and depth of burial of weed seeds. Studies have found that almost 75% of the weed seedbank was concentrated in the upper 5 cm of soil in no-till fields. In the moldboard plow system however, the seedbank is more uniformly distributed over depth. Other conservation tillage systems are intermediate to these two systems.

Weed seedling emergence is often more uniform from shallowly buried weed seeds and may result in better weed control. Weed seeds closer to the soil surface are more likely to be eaten or damaged by insects, animals, other predators and disease causing organisms.

Critical Period of Weed Control

The critical period of weed control is an important concept in IWM systems. This period has been defined as an interval in the life cycle of the crop when it must be kept weed-free to prevent yield loss.

This concept helps in determining the most effective time for non-residual postemergent herbicide applications, and reduces the practice of season-long residual herbicides, and unnecessary late applications of herbicides. The critical periods are defined relative to a crop growth stage to account for soil, weather and seasonal variations. The critical period is based on a yield loss of less than 5% due to weed interference. In other words, the crop has to be weed-free during these stages to prevent a yield loss of more than 5%.

If weeds have been controlled throughout the critical period, the weeds which emerge later will not affect yield and can be controlled prior to harvest with a

harvest aid to burn down the weeds and desiccate the crop. Herbicide band applications

Table – Critical Periods for Weed Control

Crop	Critical Period for Weed Control
Corn	4th to 10th (leaf tip)
Soybeans	1st to 2nd trifoliate
White Beans	2nd trifoliate to first flower

Corn — The critical period extends from 3 to 8-leaf stage (4 to 10-leaf tip showing in the whorl, or V2 to V6). Excellent weed control must be maintained throughout this critical period. Corn kept weed-free for approximately 34 days after planting (DAP) or until 6 to 8 leaf stage (8-10 leaf tips) had a yield loss of 0 to5% under conditions of heavy weed pressure.

Soybeans — The critical period extends from the 1st to the 2nd trifoliate stage of soybean growth (V2 to V3). Soybeans kept weed-free for approximately 15 days after crop emergence had a yield loss of 0 to5% or less.

White beans — The critical period extends from the 2nd trifoliate to the 1st flower (V3 to R1) stage of whitebean (approximately 45 days after planting).

Season-long weed control is not necessary

Alternative methods of weed control are available for all tillage systems. Studies have shown that banding herbicides will increase profitability. For example, selective application of herbicides in 30 cm bands on 76 cm wide corn rows represented an approximate 60% reduction in total herbicide applied into the environment. When complemented with inter-row cultivation, weed control and crop yields were maintained with lower herbicide costs.

Economic thresholds

Weed economic thresholds help in determining if weed density and interference is sufficient to justify control measures, i.e., if the yield loss avoided is greater than the cost of weed control. The time at which weeds emerge relative to the crop is a major determinant of yield loss. Early weeds that emerge at the same time as the crop cause more yield loss than weeds emerging after the crop is established. For example, economic threshold studies conducted with redroot pigweed, ragweed and barnyardgrass have found that the time of weed emergence in relation to the crop stage is more important than weed density when evaluating weed control options. Crop yield loss depends on the relative time of weed seedling emergence.

Corn — Corn tolerated a weed density of 4 plants/m of row when redroot pigweed emerged at the 6th leaf stage of corn, but only 0.5 plants/m when they emerged at the 3rd leaf stage of corn.

Soybean — Soybeans tolerated a weed density of 4-8 plants/m when redroot pigweed emerged at the unifoliate stage of the crop but only 0.5 plants/m of row when they emerged with the crop.

White bean — White beans tolerated a ragweed density of only 0.5 plants/m of row when the ragweed emerged with the crop, but 4 plants/m of row when the ragweed emerged at the 2nd trifoliate stage of the crop The weed densities were based on a threshold of 5%. For example, a grower scouts his/her white bean field and finds ragweed plants emerging at an average density of 4 plants/m of row, at the 2nd trifoliate stage of crop growth. Expected yield losses would be approximately 5%. Then based on his expected yield estimate, the yield loss in dollars can be estimated based on current market value. If the yield loss is $20/acre and the herbicide application will cost $25/acre, then do not spray.

Critical periods and economic thresholds however do not apply in the same way to weeds, such as black nightshade, which may reduce the quality of the crop. In such cases the economic threshold may be zero.

Mechanical Methods of Weed Control

Preemergent or "Blind" Harrowing

Blind harrowing consists of waiting until after the crop has been planted, the seed is sprouted and the shoot is about to emerge. At this crucial time, the field is harrowed to kill the small weed seedlings that have already sprouted. The crop will emerge shortly afterwards, having gained a head start on the next generation of weeds. When properly carried out, this method can be most effective in controlling annual weeds in large seeded crops. In cereals, this blind harrowing will often provide adequate control of annual broadleaf weeds. In row crops, it can be used to keep weeds down until the crop plants are large enough to withstand other mechanical control methods. Any type of light harrow can be used. Blind harrowing must not be done on crops underseeded with grass or legumes.

Weeder Harrow

A weeder harrow has spring tines that are gentle enough not to harm the cultivated crop, while uprooting or covering the smaller annual weeds. Therefore, the relative size of the cultivated plants and the weeds is important. Weeder harrowing will be most successful when used as a "blind harrowing". Specially designed weeder harrows have been developed for use on field crops at various stages of development. They can be used most effectively on field vegetables, corn, soybeans and cereals.

Rotary Hoe

The rotary hoe has “fingers” that lift and mix the soil, uprooting small weeds. It is important to work at 10–20 km/hr for satisfactory results. Best results are obtained during late morning or afternoon hours when the hot sun

can dry out the uprooted weeds. Also, crop plants tend to be more pliable at this time and injury is reduced. Rotary hoes tend to cause less crop damage

than harrows. They are also effective in breaking up a soil crust and mixing surface-applied herbicides into the soil, which will improve the weed control. On light soils or under loose soil conditions, care must be taken to keep the rotary hoe working at a shallow depth.

Inter-Row Cultivation

Shallow inter-row cultivation or scuffling of row crops uproots small weeds and cuts off larger weeds. Various types of equipment can be used but, when shovels are used, allow for up to 50% overlap for thorough weed control. Shields should be used to protect small crops.

Row cultivation can be used profitably when applying herbicides. The herbicide may be more effective and the amount of herbicide used can be reduced, particularly with band applications. To provide adequate weed control in long-season crops, such as corn, scuffling will probably have to be done more than once. The first cultivation is the most crucial since weeds that escape this pass will usually grow to maturity. Here again the relative size of the crop to the weeds is important and probably the limiting factor in achieving 100% success. Blind harrowing, weeder harrows and rotary hoes are used first so that inter-row cultivators produce good results.

Mowing

Mowing or cutting weeds may control weeds in orchards, roadsides, lawns, etc. Harvesting hay or cereal crops also helps to control weeds. Mowing cereal stubble in early August can reduce weed growth and weed seed production, especially if the cereal had been underseeded to another crop such as red clover to compete with the new weed growth. The best time to mow perennial weeds is usually at the bud stage when root reserves are low and before seed set. Note that if a herbicide application is planned for later in the season, adequate time should be left for weed regrowth after mowing. For more information, see individual crop sections.

Managing Weed Resistance to Herbicides

Resistance of weeds to herbicides is not a unique phenomenon. In fact, resistance to antibiotics, insecticides and fungicides is a world-wide problem that is not confined to any single pathogenic pest category.

Confirmed cases of pigweed resistance to the Group 2 family of herbicides have been found in Ontario. Some of these pigweed are also resistant to Group 5. This report of resistance is in addition to an already extensive list of 212 weed species throughout the world that are resistant to at least one of the Groups of herbicides listed in *Table 3, Herbicide Groupings in Ontario*. In Ontario resistance has been reported to Groups 2, 4, 5 and 22. In western Canada and the United States resistance has developed to Groups 1, 2, 3, 4, 5, 8 and 9 (refer to *Table 3*).

NOTE 1: For control of a particular triazine-resistant species, select an effective non-triazine (non-Group 5) herbicide, or select a tank mix or premix with an effective non-triazine (non-Group 5) herbicide component (see *Table 3*).

NOTE 2: Group 2 ALS resistant weeds -Biotypes of pigweed have been found that are resistant to one or more of the Group 2 herbicides. Resistant strains are difficult to distinguish from susceptible types. For control of a resistant species select an effective non-Group 2 herbicide, or select a tank mix or premix with an effective non-Group 2 herbicide component (see *Table 3*).

Delaying Herbicide Resistance

Herbicide resistance results from a change in a weed population over time after repeated application of the same group ofa herbicides. The result is reduced weed control in the field. Resistance to different types of herbicides develops at different rates among weed species and populations. To prevent or slow the development of resistant weeds on your farm, take the following common-sense approaches.

1. **Identify and Monitor:**
   Resistant weeds do not look different. Therefore, they are hard to identify. Furthermore, weed "escapes" are common after herbicide application. Resistance does not usually become obvious until 10% to 30% of the population become resistant. Survey your fields regularly and apply the methods of diagnosing herbicide-resistant weeds to catch problems as they arise.

2. **Prevent the Spread of Weeds:**
   When entering or leaving a field, clean all implements. Do not allow resistant weeds to go to seed.

3. **Use Alternatives to Chemical Weed Control:**
   Combine mechanical weed control, such as rotary hoeing or cultivation, with chemical weed control where possible.

4. **Rotate Crops and Herbicides:**
   Rotate herbicide usage so that the same herbicide group is not used year after year. One of the easiest ways to rotate to a new herbicide group is to rotate to a new crop. Then use a herbicide from an alternative group. Refer to *Table 3* for help selecting herbicides from different groups. This preplanning will prevent the same herbicide group from being used too often. When it is practical, use tank or formulated mixtures where both active ingredients within the tank act to kill the same weed in a completely different way.

5. **Keep Records:**
   Keep accurate records of crop rotations and herbicide use in all your fields. It will be easier to plan long-term weed management strategies if you have good records.
6. **Communication:**
   Stay in touch with farmer organizations, extension specialists, agribusiness, friends and neighbours about resistance problems they are encountering. Let your government or industry representative know about any cases of resistance so they can take the appropriate action to prevent spread of the weeds.

Diagnosing Herbicide-Resistant Weeds

Before assuming that any weeds surviving a herbicide application are resistant, rule out other factors that might have affected herbicide performance. Those factors are misapplication, unfavourable weather conditions, improper timing of herbicide application, and weed flushes after application of a non-residual herbicide. If resistance appears to be likely, check for the following:

1. Are other weeds listed on the product label controlled satisfactorily? Usually, only one weed species will show herbicide resistance in any given field situation. Therefore, if several normally susceptible weed species are present, reconsider factors other than herbicide resistance.

2. Did the same herbicide or herbicides from the same group (see *Table 3*) with the same site of action fail in the same area of the field in the previous year?

3. Do your records show extensive use of the same herbicide or herbicides from the same group year after year?

If one or more of these three situations apply, it is possible that the weeds are resistant to the herbicide. If resistance is suspected, control the weeds with a labeled herbicide from another group or use appropriate non-chemical weed-control methods to prevent the weeds from going to seed. Next, contact your weed specialist, herbicide supplier and the appropriate chemical company to develop a comprehensive weed-control program to manage the problem.

Use of Chemicals to Control Weeds

Chemicals may be used to control weeds either selectively in crops or non-selectively for the control of perennial weeds or on land not in crops, such as roadsides, fencerows and areas difficult to cultivate. The treatments listed in this publication are based on extensive field and observation on farms. Herbicides should not be used in cold frames or greenhouses unless specifically recommended.

Time of Herbicide Treatment in Crop Areas

The susceptibility of both crops and weeds to herbicides is related to the time of application. Therefore, it is important to use the chemical at a time when the crop is at its maximum resistance and the weeds are at their maximum susceptibility. This time will vary depending on the crop involved and the herbicide used. Terms describing the times at which herbicides may be applied, unless specified differently, refer to the stage of development of the crop plants.

Preplanting Treatments

Preplanting treatments are applied before the crop area is sown or planted. Some herbicides used in this way act on germinating seedlings, others may also kill weed seeds. When used preplanting, most herbicides must be thoroughly incorporated with the soil soon after application. Directions for incorporation are given throughout the publication where these materials are recommended.

Preemergence Treatments

Chemicals used in preemergence treatments are applied after seeding but before the specified weed or crop emerges. The chemicals may control weeds by (1) killing weed seedlings and/or (2) establishing a toxic layer of chemical on or near the soil surface in which germinating seeds and young seedlings cannot survive.

For successful preemergence treatments the crops must either be tolerant of the chemical at the seedling state or the toxicity must have disappeared before the crop emerges.

A smooth, well-prepared seedbed that is free of clods is necessary for best results. The surface soil should also be moist and the temperature favourable for the rapid germination of weed seed.

Postemergence Treatments

Postemergence treatments are applied after the crop and weeds have emerged. A selective chemical is used and the weeds are killed with little damage to the desirable plants. The types of weeds that may be controlled depend on (1) the susceptibility of the weed, and (2) the tolerance of the crop to the chemical. Treatment at the correct stage of crop development is important. Since most weeds are more susceptible to chemicals when young, early treatments will require less herbicide and will result in less damage to crops from weed competition and from spray equipment.

Sometimes a herbicide may be applied postemergence to the crop but preemergence to the weeds. For example, a crop may be cultivated, then a herbicide applied to the weed-free soil to control germinating weeds.

Chemical Weed Control in Non-Crop Areas

Treatment with "Soil Sterilants"

Perennial weeds may be killed and the growth of annual weeds prevented by the use of soil-active chemicals,

which are toxic to most plants. These "soil sterilants" may be applied at any time. Best results are obtained if application is followed by a period of rainfall.

Treatment with Translocated Chemicals

In eliminating perennial weeds, heavier dosages of 2,4-D and of other translocated chemicals must be applied than would normally be used in crop land. Mixtures of 2,4-D with other chemicals may be used to keep areas free of vegetation.

Treatment with Contact Chemicals

These chemicals are not selective but kill all foliage they contact. While this will kill annual weeds, regrowth usually develops from the roots or crowns of perennial plants.

Conservation Tillage

All herbicides recommended for use in specific crops in the conventional tillage sections of this publication can be used in conservation tillage systems provided that they are used according to the labeled uses and the labeled rates.

Minimum Tillage involves very little use of tillage equipment for seedbed preparation. The soil, however, is tilled prior to seeding, resulting in somewhat rough planting conditions by conventional standards. There is very little living vegetation and a crop residue cover of more than 20% after seeding. Weed control in this cropping system is similar to weed control in conventional tillage. Preplant incorporated herbicide treatments may not be practical if crop residues are heavy. Good uniform soil mixing is required to produce satisfactory results with incorporated herbicides. If this condition cannot be achieved without extra tillage, then the preferred method would be to use preemergent or postemergent herbicides. Use inter-row cultivation with herbicides. Burndown treatments are not normally required.

Ridge Tillage involves seeding the crop directly into the ridge formed by aggressive cultivation the previous year. The ridge planter skims off 2–5 cm of soil, crop residue, weeds and weed seeds from the top of the ridge and deposits these in the hollows between the rows. Preplant incorporated treatments are impractical with this system. This system is well suited to broadcast and/or banded applications of preemergent or postemergent herbicides. Excellent results have been obtained by band-applying preemergent herbicides at planting time to fresh, moist soil directly behind the seeding unit on the planter. Also, timely cultivation between crop rows while, at the same time, spraying the crop row with postemergent herbicides can provide excellent weed control. The ridging procedure that follows provides additional mechanical weed control. Proper adjustment of the ridge planter and early cultivation after seeding may eliminate the need for a burndown treatment. (A burndown treatment may be required prior to crop emergence if cultivation is delayed after seeding.)

Strip Tillage suggests that only narrow bands of soil in the seeding area are tilled by either power-driven rotovators or fluted coulters. The area between rows is left untilled and the crop residue is undisturbed. Success with preplant incorporated treatments depends on the amount and type of residue, the nature of the specific herbicide and the tilling device used. Row middles are not usually cultivated but could be if appropriate equipment is available for inter-row cultivation. Usually, broadcast application of preemergent or postemergent herbicides is used. Band applications could be used if inter-row cultivation is an integral part of the production system. If vegetation is present at seeding time, a burndown treatment is necessary.

No-Till cropping systems are the most demanding with regards to weed control. The crop is seeded directly into untilled soil with no follow-up cultivation. Weed control depends entirely on herbicides. Burndown treatments are almost always required. Preemergent and postemergent herbicides are used to control weeds throughout the entire growing season. Crop residues may intercept a portion of preemergent herbicide. If rainfall is sufficient to wash the herbicide from the crop residue into the soil, weed control results will be satisfactory. However, if dry conditions follow application, results could be very disappointing. Postemergent foliar-applied herbicides are more appropriate under dry conditions.

Weed Population Shifts

Weed population shifts is a term that refers to the changes in the kinds of troublesome weeds that occur with a change in tillage systems. When tillage is reduced the environment of weed seeds and underground parts of perennial weeds is altered. These environmental alterations affect weed species differently. Deep burial of weed seeds under conventional tillage systems enforces seed dormancy and increases the life of seeds, perpetuating weed problems. Reducing tillage keeps more weed seeds at the soil surface where they are subject to the ravages of nature. Greater percentages of seed at the soil surface are destroyed before they germinate (by winterkill, birds, insects or rodents). Most seeds that do survive germinate sooner and, if they are controlled, they do not return seeds to the soil. If good weed control is obtained in the early years of reduced tillage, eventually the weed seeds in the soil become fewer, reducing the potential of serious weed problems that originate from seed. Pressure from annual weeds tends to decline after a few years in reduced tillage. On the other hand, reduced tillage favours weeds that reproduce from underground roots and stems; these underground parts are not mechanically injured or destroyed in reduced tillage systems. Perennial and biennial weeds tend to be more troublesome in ridge-till, strip-till and no-till fields. In reduced-tillage fields, these weeds emerge earlier and do not spread as much as they do in conventionally tilled fields. This allows more appropriate timing for spray application and more spot treatments. The most effective herbicides are foliar-applied systemic types that translocate well to underground plant parts before the above-ground parts are killed. When non-selective herbicides are used,

perennial and biennial weeds must be treated between crops or the crop must be sacrificed in treated areas.

Burndown treatments are meant to kill existing vegetation before crops emerge. Burndown treatments may be required in minimum tillage, especially when cover crops are used; in ridge-till when seeding is delayed and/or when winter annual, biennial or perennial weeds are present; and almost always in no-till and strip-till fields. Vegetation can be killed by:

- contact herbicides like paraquat
- translocated systemic herbicides like glyphosate, dicamba or 2,4-D
- residual herbicides that have postemergence foliar activity such as atrazine, cyanazine, linuron or metribuzin plus surfactants or oils and
- a contact or systemic herbicide tank mixed with a residual herbicide such as paraquat + atrazine or glyphosate + dicamba.

All of these treatments are most effective on young, actively growing plants. Coverage is extremely important with contact treatments. Burndown treatments do not necessarily provide residual weed control.

When dense, vigourous growing vegetation is present just before or at planting time, large amounts of soil moisture are removed by that vegetation. This can be an advantage during springs when there is an over-abundance of soil moisture, but is a definite disadvantage during springs when dry conditions prevail. Because of this situation, consideration should be given to early application of burndown herbicides, perhaps even the previous fall when perennial cover crops or sod fields are involved. Under dry conditions, a rapid-acting burndown would be preferred over a slower-acting treatment.

For more specific information see also the individual crop sections such as Corn (Field and Sweet) and Soybeans.

Applying Herbicides

An exterminator's license may be required by a person applying herbicides on property other than their own domestic property. An operator's license is required by a person operating an extermination business. For further information, contact any Ministry of the Environment Regional Office or the Ministry of the Environment Pesticides Section, 135 St. Clair Avenue West, Toronto, M4V 1P5.

Successful chemical weed control requires the application of the correct quantity of herbicide uniformly over the area. With selective weed control in field crops, this application becomes a precision operation.

The chemical is applied as an emulsion, solution or suspension. The volume of the mixture used per hectare depends on the herbicide and the crop being treated. Generally, low volumes (50–200 L/ha) are used when 2,4-D chemicals are sprayed on emerged weeds, and higher volumes (150–300 L/ha) when preemergence herbicides are applied.

Small areas may be treated with a garden sprayer, or even with a watering can, if care is taken to wet all foliage.

Power equipment is necessary for larger areas. Equipment used for applying 2,4-D-like chemicals should not be used later for applying other solutions to 2,4-D susceptible crops or garden plants.

Application Technology

Introduction

Herbicide application should be a precision operation. Recent advances in equipment and control systems can make the job relatively simple and precise.

Pesticides applied incorrectly may result in wasted pesticide, poor or no control, damage to crops (possibly the neighbour's) or environmental contamination. Every effort must be made to apply chemicals properly to help eliminate these undesirable effects.

Developments in New Equipment

In building sprayers that accurately apply herbicides, equipment manufacturers work closely with the crop-protection industry. New concepts, such as closed-injection-type systems with herbicide concentrate carried separately from the water carrier, are now in use. Electronic rate controllers provide more accurate spray application by utilizing speed sensors, flow controllers and microprocessors to maintain the desired application rate. This technology has also included radar to accurately sense true ground speed of the sprayer Rate controllers are common among the professional applicators.

The industry is currently working towards the closed-injection system. Work continues in the area of drift reduction using air assists and electrostatic methods.

Nozzle manufacturers have brought to the market air-induction nozzles that significantly reduce spray drift. These nozzles are made by a number of companies and are available in a range of sizes. Operating these nozzles within their working pressure range is crucial to ensure designed spray angle development and proper air induction into the nozzle. Before buying a certain brand of air-induction spray tips, make sure your sprayer pump can produce sufficient pressure to operate these tips under all conditions. Check with the nozzle manufacturers for operating pressures required.

Sprayers for Home Use

A 9 to 14 L backpack, hand-held or compressed-air garden sprayer is satisfactory for use on lawns and around the home. A nozzle tip that produces a fairly coarse spray will help reduce spray drift. Care should be taken to keep the pressure relatively low; high pressures produce more fine spray droplets, which can drift in light winds to susceptible plants. The sprayer should be reserved for use only with herbicides and should NOT be used to apply insecticides or fungicides.

Field Sprayers

The most common sprayer used in herbicide application is the boom-type sprayer. This sprayer applies a uniform amount of spray solution across the width of the boom.

The main requirements for field spraying are:

- a uniform pressure across the whole boom
- all nozzles have the same output and a good spray pattern
- a uniform forward speed in actual field conditions
- a stable boom height to ensure proper overlap of the nozzle-tip patterns

Most commercially built sprayers can be adapted and used safely to apply liquid fertilizers. Extra agitation may be required. Ensure that the sprayer components being used are compatible with the fertilizer formulation and follow the manufacturer's recommendations.

Air-Blast or Mist Sprayers

These machines should never be used to apply herbicides, especially hormone-type herbicides such as 2,4-D. The danger of causing herbicidal damage at a great distance from the treated area is very great.

Wiper Applicators for Selective Weed Control

Wiper applicators (rope-wick, roller applicator or similar device) have been extensively used with glyphosate (ROUNDUP). Check product labels for use of this application technique with other herbicides. Product labels list the crops for which this technique is registered. The main criteria for using wiper applicators are:

- contact enough of the target plant to get herbicidal effectiveness
- keep the wick application above the crop to avoid crop injury.

Travel speeds should be 4 to 10 km/hr for wick application. Two passes in opposite directions may be beneficial, especially in heavy weed infestations and where higher vehicle speed is contemplated. Care must be taken not to contact sucker growth in orchards, vineyards and shelterbelts. This may result in crop injury. **Follow manufacturer's directions.**

Care and Use of Equipment

Spraying Speeds

Because most agricultural and roadside herbicide must be uniformly applied, the forward speed of a sprayer must be constant whenever the nozzles are delivering liquid. If the driving wheels of a tractor slip on the soil surface, the tractor's speedometer does not indicate a

change in forward speed. To be certain that the forward speed is constant in spite of wheel slippage on hills, use an independent speedometer powered by a non-driven wheel. Spray monitors and other electronic rate controllers also may be installed. Only rate controllers will automatically adjust for variation in tractor speed to maintain a constant rate of application.

Water

Use only clean water that contains no debris, sand or mud. On your farm water supply, use a frost-free water hydrant located outside the building. An anti-backflow or anti-siphon valve should always be installed on any hydrant or water supply. Never allow the intake screen to rest on the bottom of a farm pond while filling a sprayer. The intake line near the screen must, by law, be equipped with a check valve or anti-backflow device to prevent contamination of the pond or stream when the pump is shut off. The use of a tank-refilling nozzle, volume-booster nozzle or injection pump to aid in refilling the sprayer tank from farm ponds or streams must be avoided. These tank-refilling aids may cause pond or stream contamination.

Agitation

When chemical formulations in solution are used (2,4-D and water) at least 2 to14 L/min should be returned to the tank for agitation within the tank. Higher rates will apply with wettable powders. To be effective, the agitation line from the pump should pass through a control valve and deliver the liquid to the bottom (not the top) of the tank. Agitation nozzles or a sparge tube should always be used to ensure sufficient liquid circulation in the tank.

When wettable powders (atrazine, etc.) are used, the return to the tank should be 14 to 27 L/min for each 450 L of tank capacity, depending on the concentration of the wettable powder and the size of the tank. A dedicated line from the pressure side of the pump (not the pressure regulator) to the tank must be used to carry the liquid necessary for hydraulic agitation in the tank. Always use a venturi jet or sparge tube. This flow can be reduced if the sprayer has a mechanical agitator. Sparge tube agitation requires more water than venturi to give the same agitation.

To prepare a tank mix of wettable powder and an oil or emulsifiable concentrate, proceed as follows unless specific instructions are given on the product label:

- Half-fill the sprayer tank with water.
- Start the agitator and pour in a premixed slurry of wettable powder and water.
- Agitate for 2 to 3 minutes before adding more water.
- Add the oil or emulsifiable concentrate last.

Avoid excessive agitation of the mixture, as it may turn into an invert immulsion, a grease-like mass that will settle to the bottom of the tank and cannot be pumpedExcessive agitation may also cause foaming resulting in pumping problems.To prevent a build-up of oil in the sprayer, the tank should be emptied completely before refilling. After any break in the spraying operation, agitate thoroughly before proceeding. Clean the tank and sprayer immediately after use with a detergent or solvent and flush with clean water.

Pumps

The pump is the most important part of the sprayer. The pump should have adequate capacity to maintain the desired pressure, volume and agitation. Piston, diaphragm and centrifugal pumps are the best for pumping wettable-powder suspensions. For liquid herbicide applications, roller pumps may be used in addition to the above types. When used for wettable powders or flowable formulations, choose a pump with an abrasion-resistant housing. Carefully follow the manufacturer's care and storage instructions for the best pump performance.

CAUTION: Running a spray pump without water may cause damage or premature wear.

Nozzle Tips

Care should be taken to maintain a stable boom height to assure uniform overlap of the nozzle spray patterns.

The success of the spray application is dependent on the condition of the nozzle tips and uniformity of application. The spray pattern of all nozzles should be examined prior to their use.

Materials used for nozzle tips range from brass, stainless steel , hardened stainless steel as well as plastics/polymers and ceramics. All product formulations cause wear of the nozzle orifice, wettable powders more than others do.

Sprayers should be calibrated routinely. (See note on calibration below.)

Nozzle tips should be replaced when they deliver 10% more than manufacture's specifications. Worn nozzle tips may provide uneven distribution of spray solution and changes in spray pattern. They can also produce streaks across the field by uneven delivery.

Flat fan nozzle tips are widely used on boom sprayers to apply herbicides. Spraying pressure should be maintained at 275 kPa for standard flat fan nozzles. Nozzles with a spray angle of 110 degrees have more overlap resulting in less chance of spray skips as the boom moves closer to the ground. Always follow manufacturer's recommendations for spacing and minimum nozzle to target distance and spray operating pressures.

Flat fan nozzle tips that will operate at reduced pressure, approximately 140 kPa, are available. These nozzle tips can further reduce the potential of drift.

Special even-spray nozzle tips are available for band applications of herbicides. The height and spray angle of the nozzle tips as well as its orientation to the direction of travel controls the width of the sprayed band. Carefully follow manufacturer's literature and directions.

Flooding nozzle tips are used at low pressures and, because of their wide spray angle, can be used closer to the ground surface, thus reducing the drift hazard. New

flooding nozzle tip designs have improved the spray distribution pattern to the point that it is good as with the flat fan tips. Flooding nozzle tips are available in brass, plastic/polymers and stainless steel. Half as many of these nozzle tips are required to cover the same width as would be required with flat fan nozzle tips. Sprayers equipped with a broadcast type of nozzle cover a wide swath. They are especially convenient for farm lane and fencerow spraying where a uniform spray pattern is not essential. The spray pattern is affected by wind and severe drifting may occur with even a light breeze. Never use a broadcast-type of nozzle to spray near a susceptible crop.

Full or hollow cone nozzle tips may be used for applying herbicides to the soil surface when the herbicide is incorporated or mixed into the soil with a disk harrow, cultivator or similar tillage implement.

NOTE: When using any nozzle for spraying wettable powders, it is essential to calibrate the sprayer frequently because, as a nozzle wears, the quantity of spray material delivered increases and distribution is uneven. Worn nozzles will result in a very poor spray pattern.

Nozzle manufacturer's catalogues will list screens required for various nozzle types and sizes. Diaphragm check valve nozzle bodies will ensure dripless operation when the boom is turned off. To clean nozzle screens, remove them from the nozzle bodies and wash thoroughly with soap and water, using a bristle brush. Simply flushing water through the boom and nozzles will not remove pesticide residue that has built up on the outside of the nozzle screens.

Cleaning the Sprayer

Before cleaning the sprayer, dispose of surplus tank mix. As suggested in The Grower Pesticide Safety Course, one method of disposal is to dilute the remaining spray solution at least 10:1 with water. This diluted solution can be applied to the previously treated area as long as the maximum recommended product rate on the label, is not exceeded.

Clean out the sprayer immediately after finishing the day's work or when changing chemicals. At the end of each spray day, thoroughly flush out the boom with plenty of water to rinse lines, diaphragm check valves and nozzles. Delaying cleanout, even overnight, can allow the formation of hard-to-remove deposits. The sprayer tank is much more difficult to clean out, if it is allow drying. Residue build-up can also result from numerous applications of a herbicide over a period of days or weeks with no cleaning or rinsing in between. Don't forget to also clean out the measuring containers.

Steps:

- Read the product label to determine the recommended cleaning procedure. Have ready all the materials required for the cleanup, including appropriate personal safety equipment.
- Drain spray tank,
- Fill tank with water and add detergent, ammonia or other tank cleaner product and allow to agitate for 10-20 minutes (clean the whole tank not just the bottom half). Flush boom and hoses with solution, allow to stand for several hours (or overnight if possible) and then flush boom and nozzles again and drain tank. When flushing the boom, open the boom ends to get particles out of the boom.
- Inspect inside of tank for visual residues; rinse inside of tank if necessary. Repeat step 2.
- Wash outside of sprayer with soap or mild detergent and water.
- Remove nozzles, screens, and wash separately in a bucket containing cleaning solution. Don't forget to wash out your measuring container with the cleaning solution.

Thoroughly rinse the tank, hoses, booms, nozzles and screens with clean water for a minimum of 5 minutes. Repeat immediately before your next use.

Use household detergent at rate of 250 ml/100 L or 1 kg/150 L of water. Use ammonia (3%) at 1 L/100 litres of water. Use other cleaning agents according to label directions. **Never** mix ammonia with chlorine bleach Chlorine gas is produced which may cause severe eye, nose, throat, or lung irritation.

NOTE: Contact the manufacturer of pesticides being used to determine the best methods and product(s) to clean residue from tanks and associated equipment. **Read the label,** since many products, e.g. ACCENT, BANVEL II, CONQUEST, PEAK, etc. provide tank-cleaning information on their label. Some products such as AGRAL 90, or ALL CLEAR, are recommended as tank cleaning agents.

Equipment that has applied Group 4 (2,4-D, MCPA or related phenoxy herbicides) or many of the Group 2 herbicides should not be used to spray fungicides or other materials on susceptible crops and should not be parked or stored near greenhouses or other areas where susceptible crops are grown.

Clean the spray tank, booms and hoses first. Be sure to also clean the nozzles and tips, screens, filter, strainer and pump. These parts are often overlooked, and can trap residues. Because of today's highly active, low-use-rate herbicides, it is essential to clean out every trace of herbicide.

When surfactants or fertilizer solutions (e.g., AGRAL 90, 28% UAN) are used in a recommended mix with herbicides, there may be some inadvertent cleaning of previous residues from the tank/equipment that could affect the crop. Proper cleanout when changing products is essential to prevent crop injury.

The wash water contains herbicide. Never allow wash water to run into a well, lake, pond, river or other water source.

Do not leave puddles that may be accessible to children, pets, farm animals or wildlife

Sprayer Calibration

Field Boom-Type Sprayer Calibration

(Determining application rates in L/ha.)

There are many ways of determining the number of litres of spray material that are being applied to one hectare of land.

Instructions

1. Measure the time.
   - Place two stakes 50 m apart in the field.
   - Select the gear and throttle setting (rpm) at which you plan to spray. Half-fill the sprayer with water.
   - Drive the distance between the stakes three times, timing each pass. Each time, make sure the tractor is at the desired speed as you pass the first stake. Keep driving at this speed until you pass the second stake.
   - Note the average time of the three passes.

2. Measure the average nozzle output.
   - Park the sprayer with the PTO engaged and the throttle adjusted to reach the PTO speed set in the test run.
   - Adjust the pressure regulator to the desired working pressure with full flow to the boom.
   - Collect the output from each nozzle for the average length of time needed to travel the 50 m in the test run.
   - Enter the nozzle outputs into the equation below.
   - If any nozzle is more than 5% above or below the average output, it should be cleaned or replaced.

3. Measure the nozzle spacing in metres.

4. Use the following formula to determine the sprayer output:

$$\text{Sprayer Output (Litres/hectare)} = \frac{\text{Average Nozzle Output (mL)}}{\text{Nozzle spacing (metres)}} \times 0.2$$

5. Calculate the actual area sprayed after each tank of spray solution is applied. Re-check the sprayer calibration after each tank of spray is applied by dividing the volume sprayed by the area sprayed. The nature of some products may slightly alter the calibration from that of clean water.

6. Growers who prefer to measure in litres/acre or gallons/acre can use the following conversion guide.
   - Litres per hectare x 0.4 = Litres per acre
   - Litres per hectare x 0.09 = Imperial gallons per acre
   - Litres per hectare x 0.11 = U.S. gallons per acre

Sample Calculation

Average time to travel 50 m (164 ft) = 24.5 sec

Average amount of liquid collected per nozzle for 24.5 sec = 525 mL

Nozzle spacing on the boom = 0.5 m (approximately 20 in.)

$$\text{Application rate} = \frac{525 \text{ mL}}{0.5 \text{ m}} \times 0.2 = 210 \text{ L/ha}$$

210 L/ha x 0.4 = 84 L/acre.
210 L/ha x 0.09 = 18.9 Imp. gal/acre.
210 L/ha x 0.11 = 23 U.S. gal/acre.

Band Spraying: If the sprayer has 10 nozzles and each nozzle covers a 36 cm (0.36 m) band, the total width of the spray patterns (swath width) is: 10 x 0.36 or 3.6 m.

Note 1: Sprayer-calibration bottles or kits are available from a number of suppliers. For further information contact your local office of the Ontario Ministry of Agriculture, Food and Rural Affairs or manufacturers of sprayers, sprayer parts or herbicides.

Note 2: For banded-spray applications, measure the width of the spray band (at the soil surface or surface of the crop canopy) and enter this value into the formula instead of the "nozzle spacing." Note that in band spraying the acreage sprayed is NOT the same as the crop acreage. (When broadcast spraying a row crop with 1 m rows, the whole field is treated. A band spray may only treat 30 cm over each row. Therefore, only 1/3 of the field is actually treated.) The herbicide rates referred to in most herbicide publications and labels refer to the actual area sprayed unless otherwise stated.

Hand-Held/Backpack Sprayer Calibration

Many people use small hand-held or backpack sprayers for treating problem areas or spraying areas that were missed. Calibration of these sprayers is as important as calibrating your field sprayer.

Method I

1. Measure an area that is 100 sq. m. e.g., 10 m x 10 m, or 25 m x 4 m.
2. Fill the spray tank with water. Mark the level on a measuring stick. Pump to the pressure that will be used during the pesticide application.
3. Spray the water over the 100 sq. m area. Walk at a steady pace, taking care to apply it as evenly as possible, just as you would when applying pesticide.
4. Measure the amount of water needed to refill the spray tank to the mark on the measuring stick. This amount will be the sprayer output per 100 sq. m.

Method II

1. Set two stakes 50 m (164 ft) apart in the field.
2. Half-fill the sprayer with water
3. Walk the 50 m three times at a steady pace. Calculate your average time to travel the 50 m.
4. Measure the width of the band sprayed by the nozzle (in metres) at your walking pace.

5. Pump the sprayer for the same amount of time as calculated in step #3, collecting the liquid from the nozzle in a measuring device.
6. Application rate (L/ha)= $\frac{\text{mL liquid per nozzle x 0.2}}{\text{Band width (metres)}}$

Method III

1. Partially fill sprayer. Pump to the pressure you will use during the pesticide application.
2. Spray to determine width of swath (in metres).
3. Walk at a steady pace for 15 sec. Measure the distance (in metres).
4. Multiply spray width times distance traveled to provide the area (in square metres) sprayed in 15 sec.
5. Spray into a measuring device for 15 sec. (Gives amount of solution sprayed in 15 sec.)
6. Application rate (L/ha) = $\frac{\text{amount sprayed}}{\text{area (length x width)}} - \frac{\text{L x 10,000}}{\text{sq. metres}}$

To convert the application rate of any pesticide to the amount required for a small area, follow this guide:

- 1 kg/ha is equal to 10 grams/100 m^2
- For liquid measure, 100 L/ha is equal to 1L/100 m^2

Source: Ontario Pesticide Education Program Manual 1995.

Determining Amount of Herbicides Needed

Determining amount of product per hectare

Most rates suggested in this publication are given in terms of both active ingredients (common name) per hectare and product (TRADE NAME) per hectare. However, where the amount of active ingredient in the formulations varies considerably (for example, 2,4-D is available in concentrations of 100 grams/L, 400 grams/L, 500 grams/L, etc.) The rate is given in terms of active ingredient only.

Note: Throughout the Crop Recommendations sections of this publication, the common name of each herbicide (its active ingredient) is printed in lowercase letters (e.g., atrazine, dicamba, glyphosate), whereas the product trade name (the name of the liquid or powder etc., inside the container as supplied by the manufacturer) is printed in capital letters (e.g., AATREX, BANVEL II, ROUNDUP TRANSORB), and its formulation is listed within brackets following the trade name.

Determining amount of product required per tankful

After determining how much commercial product is needed per hectare, calibrate the sprayer and determine the number of hectares each tank will cover. Determine the quantity of herbicide needed to add to the spray tank using the following formula:

Product required/tank = hectares covered by tank x product rate/ha

Sample calculations:

(a) product/tank = 4.1 ha 2.2 kg/ha
= 9.02 kg LOROX/tank

(b) product/tank = 4.1 ha x 4.5 L/ha
= 18.45 L ATRAZINE/tank

Follow manufacturer's recommendations on mixing order and procedures.

Materials, Mixing and Mixtures

Dry herbicide formulations include granules, soluble powders and wettable powders. Granules do not require any mixing, and are ready to apply as is. Many herbicides used for preemergence treatments are available as granular formulations. In nearly every case, the performance of the granular formulations is equivalent to that of the liquid. Soluble powders can be dissolved in water. Wettable powders will not dissolve but will form a suspension that requires constant agitation.

Liquid herbicide formulations either mix in water to form a solution or may be oil-based and form an emulsion that will require agitation.

Note: When using more than one herbicide in a single application, it is safer to first mix one with the quantity of water to be used before the second is added. This reduces the possibility of gums or precipitates forming, which may clog nozzles and filters. Consult the package labels for information on the compatibility of different herbicide products as certain formulations may react when mixed together, resulting in materials with different properties and activities than the original ones. Where water is known to have an excessive salt content, compatibility of the water and the chemical at field strength should be tested first on a small scale. See note on Agitation in Care and Use of Equipment.

Mixtures of different herbicides or mixtures of herbicides with pesticides or foliar fertilizers should NOT be applied in a single application unless registered for use in this way.

UNLESS specifically mentioned in this publication, or on a herbicide label, the addition of a surfactant or a detergent to a spray solution is NOT recommended.

Application Indicators

Colourants/Foam Markers for Pesticides Application

Colourants added to the pesticide solution help show where pesticides have been applied. Foam marking systems help minimize overlap. Adding a colourant to the basal sprays of herbicides on cut stumps of woody plants helps assure thorough coverage without respraying. Water-soluble colourants can also be useful in lawn spraying. Examples of colourants are listed below.

- Bullsey Basal 55: blue, oil soluble
- Blazon: blue, water soluble
- Bas-oil Red : red, oil soluble

Colourants are available through agricultural chemical dealers.

Additional Information

Video #39 Field-Crop Sprayer Calibration.

#44 Nozzle Selection for Field Sprayers.

Available from:

Independent Study, University of Guelph,
Guelph, Ontario Canada N1G 2W1.
Phone (519) 824-4120 ext. 3375.

Factsheets

98-095, Pesticide Contamination of Farm Water Supplies

96-025, Ways to Avoid Pesticide Spills

94-037, Pesticide Handling Facility

89-110, Flat Fan Nozzle Tips For Field and Weed Sprayers

88-129, Field Sprayer Calibration

88-118 , Reducing Pesticide Drift and Crop Damage

87-057, Pesticide Container Rinsing

Precautions With All Pesticides

General Precautions

1. Before opening pesticide containers, always read the label and follow all precautions and directions. Keep a record of the common names of all the pesticides you handle, especially those listed as hazardous in this publication. Other members of your family need to know about this list in case there is an accident.
2. Never smoke, chew tobacco or eat while handling or applying pesticides. Do not carry tobacco or food in clothes worn while spraying. Change your clothes and wash before eating.
3. When handling and mixing pesticide concentrates, rinsing empty containers or repairing leaks, wear a full set of protective clothing. This includes a waterproof cap, coveralls, impervious gloves and boots, and safety goggles. If you are using highly or extremely toxic pesticides or very dusty formulations, wear a respirator. If you are handling dusty formulations, wear a dust mask. If you are handling volatiles or gases, you must wear a respirator. If these gases are highly dangerous or you are handling them in an enclosed space, you may need a self-contained breathing apparatus. Make sure you follow the specific instructions on the pesticide label.
4. When you draw water from wells, ponds, streams or other sources, use an anti-backflow device to prevent back-siphoning. Mix pesticide at least 50 m from wells, ponds or streams. Triple or pressure rinse the empty container and add the rinse water to the tank. Only mix enough solution to do the spray job. When you have finished loading and mixing, wash down your gloves and boots with clean water before removing them.

Always read the label and follow the instructions on it.

5. During application, a tractor cab with charcoal filter gives adequate protection against exposure. Wear impervious gloves, boots, coveralls and cap when tending to stoppages. When using airblast and mist blowers or in tractors without cabs, wear waterproof suits and caps and impervious gloves and boots. When applying fumigants in the field, have a respirator on hand in case you need to deal with equipment problems or in case inadequate sealing in the soil allows the fumigant to escape.
6. When the spray operation is done, bathe or shower to remove pesticide deposits on your skin. Do not handle anything in your home before you bathe.

Preventing Contamination of Farm Water Supplies

Pesticides can contaminate well, pond and surface water. In fact, it is an offence to contaminate surface waters with pesticides. Taking the following steps will help prevent contamination.

- Keep pesticide concentrates above the flood plain in locked storage.
- After emptying, triple or pressure rinse, crush and dispose of containers.
- Return empty plastic or metal containers to a dealer who participates in the container recycling program. Empty bags may be burned or disposed at a landfill site.
- Mix pesticide and load sprayer at least 50 m away from any water supply.
- Use buffer zones and berms to avoid contaminating surface water, wells, ponds and streams.
- Do not use drinking water sources to fill spray equipment. If you fill your tank from a well, lake, river or other surface water source, you must use an anti-backflow device.
- Do not spray within 10 m of shallow wells or 5 m–10 m of other water supplies in ideal weather and farther away if there is any air movement. Stop spraying when wind velocity reaches 10 km/hr. See the product label for more details on these precautions.

If An Accident Occurs

1. Wash your gloves, boots, and respirator before removing them. Take off your clothing, including underclothes, immediately and wash contaminated skin thoroughly with soap and water. Soak clothes immediately and double launder them as soon as possible. If the spill was serious, place the clothes in a plastic bag and dispose of them in a safe manner. Wash your gloves, boots and respirator again.
2. If clothing becomes wet with a pesticide, remove it immediately, wash and put on fresh clothes.

If your clothes get wet with a pesticide, remove them — immediately!

3. If symptoms of illness occur during or shortly after handling a pesticide, go to a hospital. Take your list of common-name chemicals with you. (See Emergency Procedures for Pesticide Poisoning on the inside back cover.)

4. Clean up any pesticide spills immediately. In the case of minor spills, use dry soil or other absorbent material such as kitty litter to remove excess liquid. Sweep up powders and granulars. Contaminated soil and sweepings should be spread over a large area of bare soil to facilitate rapid degradation. Make sure you are adequately protected when cleaning up the spill. For information on preventing spills see OMAFRA factsheet, *Ways to Avoid Pesticide Spills*, Order No. 96-025.

[redacted]

5. If a well becomes contaminated, follow the clean-up instructions in OMAFRA factsheet, *Pesticide Contamination of Farm Water Supplies*, Agdex 607, Order No. 86-077.

EMERGENCY PROCEDURES FOR PESTICIDE POISONING AND FIRST-AID INFORMATION

(See Inside Back Cover)

Relative Toxicity to Applicator

Definitions

Lethal Dose 50% (LD50) The dose that, when administered, will kill 50% of the test animals within a stated period.

Acute Toxicity Immediate adverse effects from a single or short period of exposure to a substance, either by the oral, dermal or inhalation route.

Chronic Toxicity Adverse effects resulting from repeated exposure to a substance over an extended period.

High Acute Toxicity These pesticides are extremely dangerous if handled carelessly. The acute oral LD_{50} is less than 50 mg/kg of body weight, and the acute dermal LD_{50} is less than 200 mg/kg body weight. These pesticides can be fatal if you take less than 0.1 to 3.0 mL (1 drop to half a teaspoon). These pesticides are labelled with the skull and crossbones in a stop sign. You must use a respirator and eye protection along with all other protective clothing when using these products:

azinphos methyl	(Guthion, Sniper)
carbofuran	(Furadan)
disulfoton	(Di-Syston)
endosulfan	(Endosulfan, Thiodan)
fensulfothion	(Dasanit)
fonofos	(Dyfonate II)
methomyl	(Lannate)
phorate	(Thimet)
terbufos	(Counter)
terbufos + phorate	(Cygard)

Moderate Acute Toxicity

These pesticides are dangerous if handled carelessly. The acute oral LD_{50} is 50 to 500 mg/kg of body weight, and the acute dermal LD_{50} is 200 to 2,000 mg/kg body weight. These pesticides can be fatal if you take 3 to 30 mL (half a teaspoon to 2 tablespoons). These pesticides are labelled with the skull and crossbones on a stop sign. You should wear a respirator when handling these concentrates:

cyanazine	(Bladex)
chlorpyrifos	(Lorsban)
deltamethrin	(Decis)
diazinon	(Basudin)
dimethoate	(Cygon, Lagon)
phosmet	(Imidan)
tefluthrin	(Force)

Low Acute Toxicity

These pesticides are not fatal unless deliberately ingested in amounts of over 30 mL (1 oz.). The acute oral LD_{50} is greater than 500 mg/kg body weight, and the acute dermal LD_{50} is greater than 2,000 mg/kg body weight. Pesticides listed in this publication and not in the prior lists in this section have low acute toxicities. You should handle them with caution. You must wear protective clothing. You should wear safety goggles, and if using these products in a confined space, you should use a respirator.

Chronic Toxicity

It is not possible to assess chronic toxicity of a pesticide in the same way an LD_{50} is used to determine acute toxicity. Instead, a number of tests performed on animals help predict whether a pesticide may cause long-term effects. Animals are examined for a wide variety of toxic effects such as the production of tumors or abnormalities. Using protective clothing and equipment will help reduce exposure and the risk of chronic effects.

Entering Treated Areas

Workers may be poisoned if they enter fields without wearing protective equipment too soon after pesticides have been applied. Such poisoning can result from handling treated plants or from inhaling pesticide vapours. The list below shows a specific minimum interval that you must observe between applying pesticide and working in the crop without protective equipment. Some pesticides, like parathion, have labels that carry a warning about working in treated crops. Follow the label recommendations.

Otherwise, keep to the following minimum intervals:

24 hours	48 hours
methomyl (Lannate)	azinphos-methyl (Guthion, Sniper)
methidathion (Supracide)	Carbofuran (Furadan)*

* If prolonged direct contact with corn foliage will occur, do not enter treated fields within 14 days of application without wearing protective equipment.

Blood Tests For Those Applying Pesticides

Organophosphorus and carbamate pesticides are capable of inactivating a person's serum and red blood cholinesterase levels. If cholinesterase activity falls below a critical level, poisoning can result. Symptoms include fatigue, dizziness, nausea, trembling, blurred vision and difficulty breathing.

If you use these groups of pesticides, have your family doctor check your cholinesterase levels. To be of value, the tests should be started before you use these pesticides, since the normal level can vary considerably, making it difficult to assess the degree of suppression. In this publication, the insecticides of primary concern are:

azinphos-methyl	(Guthion, Sniper)
carbaryl	(Sevin)
carbofuran	(Furadan)
chlorpyrifos	(Lorsban)
diazinon	(Basudin)
dimethoate	(Cygon, Lagon)
disulfoton	(Di-Syston)
fonofos	(Dyfonate II)
methomyl	(Lannate)
phosmet	(Imidan)
phorate	(Thimet)
terbufos	(Counter)
terbufos + phorate	(Cygard)
trichlorfon	(Dylox)

Protective Outdoor Clothing

Why Use Personal Protection?

Pesticide formulations vary in toxicity from slightly to extremely poisonous. Exposure occurs once the pesticide is removed from the container. The toxicity of the pesticide and exposure to the user create a hazard. Both can be reduced, toxicity by dilution and exposure by protective clothing. You can reduce the hazards of spraying and thus the risk of poisoning. Wearing protective clothing reduces the risk.

Risk of each stage

Handling and mixing concentrate .....very high risk
Rinsing empty containers .....high risk
Applying outdoors.....low to high risk
Applying indoors..... medium to very high risk
Cleaning up, rinsing equipment..... medium to high risk
Entering treated area within 48 hours... low to very high

Reducing Exposure

Exposure can be through skin, eyes, mouth or nose. About 80% to 85% of the exposure in most spray operations is during mixing and loading concentrate. Field application usually accounts for 15% to 20% of the exposure. Skin exposure is usually 90% to 100% of the total exposure. Around 70% of this is by way of the hands and forearms and 30% involves the rest of the body. Inhalation (nose and mouth) exposure is normally 0.1% but rises to 5% to 10% with mist blowers and air blast sprayers.

Protective clothing

To reduce skin (dermal) exposure, wear impervious gloves. Always refer to the product label. Unless the label says otherwise, use neoprene or nitrile gloves. Always wear waterproof boots, along with coveralls, apron or spray suits and waterproof cap. Coveralls can be reusable or disposable. Reusable coveralls are normally cotton or polyester and should be tightly woven. It's easier for the pesticides to penetrate polyester than cotton.

Disposable coveralls are polyethylene and may be laundered several times. Spray suits should be used in highly hazardous conditions such as with mist blowers and air blast machines. Protect your eyes with safety goggles when working with any pesticide concentrate.

Respirators

Use respirators when handling pesticides with labels that call for respiratory protection and carry the warning stop sign with skull and crossbones. Use respirators when spraying any pesticide rated as high toxicity or when applying any liquified gas. Respirators are available as air purifiers or self-contained units and come in a wide range of shapes and sizes. Consult the label and your nearest safety supply company for advice. Make sure the cartridge or canister you use has a safety-approved sticker with the letters NIOSH (National Institute for Occupational Safety and Health) on it.

Washing protective clothing

To keep your protective clothing and equipment functional, clean it thoroughly. Never let children or pets come in contact with contaminated clothing or equipment. Launder clothing promptly, wash and store other personal protection items and rinse spray equipment and store it away to prevent children playing with it.

Fabric clothing

If fabric is saturated with the concentrate of a highly toxic pesticide, throw it out. Wear nitrile or neoprene gloves when handling severely contaminated clothing. Remove the clothing carefully and immediately put it in a plastic bag and dispose of it in a safe manner. For a normal spray operation, follow these guidelines, preferably twice a day, but at least at the end of the work day:

Table B Safety Supply Companies in Ontario Providing Protective Clothing or Respiratory Devices

Made by:	Available from	Branches	Telephone
E.A.R., AOSafety, Peltor , Eastern	Aearo Canada Ltd. 7115 Tomken Road, Mississauga, Ontario L5S 1X7		(905)795-0700
H.S. Cover Survivair 3M Canada Company	Levitt-Safety Ltd., 2872 Bristol Circle, Oakville, Ontario L6H 5T5	Kitchener, London, Ottawa, Sarnia, Stoney Creek, Sudbury, Thunder Bay	(905)829-3299
Kasco Helmets	P.O. Box 430 20 Consolidated Dr. Paris Ontario N3L 3T5		519-442-2046
Mine Safety Appliances	MSA Canada Inc., 148 Norfinch Drive, North York, M3N 1X8		416-667-9400
3M Canada Company Occupational and Environmental Safety Products	A wide range of distributors. Contact : P. O. Box 5757, London, N6A 4T1		519-451-2500
North	North Safety Products, 26 Dansk Court, Etobicoke, M9W 5V8		416-675-2810
Kit Care Corp	91 Kelfield St., Unit 6, Rexdale, M9W 5A3		416-243-3030

Many of these companies also have dealer outlets. For details contact the supply company

- Rinse clothing outdoors
- Soak and wash protective clothing separately from other clothes
- Soak protective clothing with detergent, in a container such as a large bucket or tub; or use the pre-wash cycle of an automatic washer, with detergent. Solvent-based, pre-wash products work on EC pesticide formulations
- Wash only a few garments at a time
- Use heavy-duty liquid detergents
- Use hot water, the highest water level, and a regular hot super-wash cycle
- Do two complete wash cycles, each with a double rinse
- After washing, run another wash cycle with detergent and no clothing, to decontaminate the washing machine
- Hang the clothes to dry, outside if possible, to avoid a potential build-up of pesticide residue in the dryer

Rubber, Vinyl, or Plastic Boots and Gloves

To avoid getting pesticide on your hands, wash the outside of your boots and gloves with detergent and water before taking them off. After removing boots and gloves, wash them inside and out with detergent and water, rinse them thoroughly, and dry them in a well-ventilated area.

Chemical-Resistant Clothing, Goggles and Face Mask

Wash plastic or rubber clothing and equipment with detergent and water, rinse thoroughly, and dry in a well-ventilated area.

Respirators

Discard cartridges, canisters and filter pads when breathing becomes difficult, when you notice a pesticide odour, or at the interval set by the manufacturer. Make a note of the date the cartridge is

first used. Remove cartridges and filter pads from the face piece and store them in clean, sealed plastic bags. Wash the face piece in detergent and water, rinse it thoroughly, and dry it in a well-ventilated area. Never use alcohol or other solvents for cleaning, as they will damage the rubber and plastic.

Consult

Consult the safety supply house of your choice for help in selecting your protective clothing. (See Table A.)

Protective Devices to be Used in Enclosed Areas

Canister Gas Masks

Canister gas masks are effective for protection against certain harmful gases, vapours and particulate matter. They are generally suitable for ventilated areas not subject to rapid change, but should never be used in confined spaces where oxygen deficiency and high gas concentrations may occur.

Self-Contained Breathing Apparatus

Air purifying apparatuses do not work in confined spaces where gas concentrations are unusually high. The lack of oxygen can prove fatal. Under these conditions, you need an air supply provided by a self-contained breathing apparatus (e.g., Scott Air Pack). Using substances that produce hydrogen cyanide, methyl bromide, chloropicrin, or phosphine can produce high gas concentrations and oxygen deficiency as can smoke generators, foggers using highly toxic pesticides, and some volatile sprays.

Other Protective Clothing

Wear other protective clothing in keeping with requirements listed on the pesticide label.

Working Conditions

Use canister gas masks when the surrounding air contains low concentrations of toxic gases, vapours or particulate matter derived from soil-drench, granular, dust, or foliar spray applications. Pesticides applied in this manner usually have moderate to low toxicity. You must use a self-contained breathing apparatus (e.g., Scott Air Pack) when applying highly toxic pesticides. These can produce high concentrations of toxic gases, vapours or particulate matter, and a lack of oxygen, especially in an enclosed space (e.g., fumigating grain). Contact your safety supply company for their recommendation.

Space Fumigants and Insecticide Smokes

Learn about the health hazards and toxic properties of the pesticide you're using.

When using fumigants or insecticide smoke generators, wear protective clothing to prevent skin and inhalation exposure. During and after treatment, lock the building and post warning signs. Follow instructions on the product label regarding aeration of treated buildings, warehouses, grain storage bins or areas before letting anyone enter.

Fumigants

An agriculturalist using methyl bromide plus chloropicrin or aluminum phosphide to fumigate greenhouses, vaults, warehouses and grain storage must obtain a permit issued under the *Pesticides Act*. To apply for a permit, contact the local pesticides officer with the Ministry of the Environment. Remove livestock and poultry that are in the same building, especially if they are under the grain bin. As a safety precaution, have someone else who is wearing personal protective equipment help with the fumigation.

Always consult the product label.

When handling methyl bromide, do not wear gloves because these will trap gas next to the skin. You must wear a full-face respirator with organic vapour canister or positive pressure breathing apparatus. When handling aluminum phosphide, use cotton gloves and wear a full-face mask respirator with an acid gas canister.

For more information, obtain Methyl Bromide Structure Fumigation Procedures and Aluminum Phosphide Structure Fumigation Procedures from the Ministry of the Environment.

Storing Pesticides

The Ontario *Pesticides Act* and *Regulation 914* require that all pesticides be kept out of the reach of children, irresponsible persons, pets and livestock. They should be stored in a locked facility away from food and feed. Herbicides should be stored separately from other pesticides to avoid contamination.

Always store pesticides in their original containers and keep them tightly closed. Never put pesticides in unmarked containers. In areas where flooding has been frequent, you must store fertilizers and pesticides above the known highwater mark. Contamination of water by these chemicals has led to serious health problems for humans and domestic animals as well as fish and wildlife.

See also OMAFRA factsheet, *Pesticide Handling Facilities*, Order No. 94-037.

Schedule 1, 2 and 5 pesticides

Schedule 1, 2 and 5 pesticides must be stored in a locked facility that is ventilated to the outside. A sign that says "CHEMICAL STORAGE WARNING—AUTHORIZED PERSONNEL ONLY" in block capitals must be fixed to the outside of each entrance.

Only the certified agriculturalist or someone under that person's supervision can enter the storage facility.

Disposal of Pesticide Containers or Contaminated Material

All paper or cardboard pesticide containers, paper packaging material or other paper material used to clean up spills should be burned or disposed of at a landfill site. Make sure that people and animals are kept away from the smoke and that the smoke is not directed toward buildings, highways, roads or outdoor public areas. Plastic material must not be burned.

Unrinsed containers can contain as much as 3% of the original formulation. If this amount of toxic pesticide is discarded with the container it could be dangerous to other people handling it or to the environment (for example, your water supply). Failure to rinse is also wasteful. Use that 3% for the reason you bought it — to control the pest!

Rinse all metal, plastic or glass containers three times with water and add the washings to the spray tank. Or use a rinsing device. These rinsers can be used to puncture the bottom of a metal or plastic container and rinse the residue directly into the spray tank. This procedure takes less than a minute. Return the rinsed containers for recycling to any dealer cooperating in the pesticide container collection and recycling program.

Dispose of unwanted or contaminated pesticide through Laidlaw Environmental Management (519-451-6630), or contact the appropriate registrant to develop an alternative method acceptable to the director under the *Pesticides Act* (416) 327-5519.

New Packaging Method Available

To simplify disposal of empty pesticide packages, the industry has re-introduced a soluble package that dissolves in the tank of the farm sprayer. Water-soluble packaging under the names such as Clean Pak, Solupak, and Toss-N-Go is used for dry flowable and wettable powder formulations of pesticides.

In the majority of cases, the water-soluble packaging material is PVA (poly vinyl alcohol). This material dissolves completely when added to the water in the sprayer tank according to instructions.

Handling

- Do not allow water-soluble pouches to become wet prior to adding them to the sprayer tank.
- Do not handle the pouches with wet hands or wet gloves.
- Do not remove water-soluble pouches from the overwrap (outer package) except when adding them to the sprayer tank.
- Always reseal the outer package to protect the remaining pouches from moisture.

Mixing

- After spray tank is one-quarter full of water and the agitator is running, add the water-soluble pouches to the tank.
- Depending on the water temperature and the degree of agitation, these pouches dissolve completely within five minutes.
- As tank continues to fill, add any other compatible pesticides.

Compatibility

- Do not add a pesticide that is incompatible with the PVA packaging material. The PVA material is not soluble with summer-type oils (e.g., Superior Oil).
- Do not combine with the pouches any material containing boron (e.g., Solubor), chelated micronutrients or water-soluble fertilizers. The combination is likely to cause a sticky, insoluble substance in the tank.
- After applying boron, chelated micronutrients or water-soluble fertilizers, completely empty and rinse the spray tank before using any product packaged in PVA.

Read all labels and instructions carefully. For more details contact your farm chemical dealer.

Sprayers

Herbicide sprayers that can deliver enough litres per hectare for adequate coverage are satisfactory for applying emulsion-type insecticides. However, if 2,4-D or related herbicides have been used in them, the sprayers will have to be cleaned thoroughly or foliage may be damaged. The detergent used should contain ammonia.

For applying the wettable powder formulations, adequate agitation is essential. Pumps should be capable of delivering the flow and pressure required as well as being compatible with materials sprayed. Keep in mind that the higher the pressure, the greater the danger of drift to other crops.

Calibrate your sprayer at least twice during the growing season with each set of nozzles used. The wear on nozzles and other parts will alter the amount of spray delivered. Check all nozzles for flow rate at least once a year. Replace nozzles when their output is 10% greater than rated output.

Band Spraying of Insecticides

When banding insecticides, apply the recommended rate over the strip of row you wish to treat. While banding does not use a more concentrated spray mixture, it does allow you to cover more area with the same amount used for a broadcast application. For example, if you are treating only a third of the row width, you will be able to cover three times the area compared to a broadcast application.

Application by Airplane or Helicopter

Aerial applicators must obtain a Commercial Aerial Applicators license from the Ontario Ministry of the Environment to apply pesticides. In addition, they need permits from the Ontario Ministry of the Environment to apply Schedule 1 and 5 pesticides and Schedule 2 hormone-type herbicides. Ministry personnel will inspect the area to ensure the application is done safely.

It is an offence under the federal *Pest Control Product Act* to use a control product under unsafe conditions. Precautions must be heeded at all times to prevent drift. Extra precautions should be taken when using insecticides applied by air, especially those known to be toxic to honeybees, such as Sevin (carbaryl).

Applications should not be made if the wind is blowing. Even on the calmest day, some drift occurs. To keep it to a minimum, apply pesticides in the evening or early morning.

Be sure that the contract specifies the product to be used and its rate of application. Only products specifically allowing aerial use may be applied by aircraft.

Pesticide Drift

Pesticide drift can leave residues on adjacent crops, be a hazard to nearby people and livestock, and reduce the amount of material in the target area so that it is ineffective. People applying pesticides should make every effort to minimize or prevent pesticide spray drift by doing one or more of the following:

- being aware of the toxicity of the pesticide being used
- read the label
- use buffer strips around water courses and neighbouring fields
- select the correct water rate
- proper nozzle selection
- be aware of the weather conditions
- spray plume protection (hoods, shrouds, screens and air curtains)
- use drift reducing adjuvants
- utilize wick weeders
- select the correct nozzle-to-target distance
- don't spray if conditions are not suitable

Growers are responsible for any material discharged from their sprayers no matter where it is found. This includes liability for adverse affects such as damage to crops or to ornamental plants and illegal or unacceptable residue on neighbours' crops or property. You could also be responsible for injury resulting from car accidents caused by windows smeared by spray drift or allergic or asthmatic reactions of bystanders even if they are not on your property. Take all precautions necessary to prevent drift off site that might implicate you in any damaging action.

For more information consult OMAFRA factsheet, *Reducing Pesticide Drift and Crop Damage*, Order No. 88-118, OMAFRA/Agriculture and Agri-Food Canada booklet *Best Management Practices - Pesticide Storage, Handling and Application* and the Ridgetown College video *How to Manage Spray Drift*.

Residues on Crops to be Harvested, Fed or Grazed

Some pesticide residues disappear quickly; others persist in poisonous form. When crops with persistent residues are fed to livestock the poisons may accumulate in the body fat, and milking cows will excrete them or their metabolic products in the milk. Young calves, heifers, and dry cows will store them in body fat and secrete them when they freshen months later. Do not use crop residues treated with Thiodan or Endosulfan for bedding.

To avoid exceeding the residue tolerance for insecticides, herbicides and fungicides,

Do not apply them later than recommended.

Apply only those registered for the crop and pest.

Do not apply more than the recommended amount.

Do not apply them more often than recommended on the label.

When controlling insects, for example, do not apply an insecticide later than the recommended number of days from harvest. For example, Malathion 500 EC 2 - 2.75 L (7 days) indicates that the malathion spray should not be used later than seven days before the beginning of harvest and that no more than 2.75 L of an emulsifiable concentrate formulation containing 50% malathion should be used for one hectare of crop in an application.

Bee Poisoning

Honeybees, as well as other bees and insects, are important pollinators of several field crops including alfalfa, canola, clover, and trefoil. These pollinators are critical to maximizing seed production. Some crops such as canola and legumes are important sources of honey. These crops, and also corn, are important pollen sources. It is therefore important to refrain from poisoning bees foraging on these crops.

Insecticides are required for insect control. With careful management, you can get good insect control without killing bees. The following are a few points to remember in preventing bee poisoning.

1. Do not spray any flowering crop on which bees are foraging. If you must apply insecticides, spray in

the early morning or in the evening when bees are not foraging. Bees usually do not forage at temperatures below 13°C.

2. If you must apply an insecticide poisonous to bees when they are foraging, notify neighbouring beekeepers so that they can protect their bees.
3. Do not apply insecticide on windy days to prevent drift toward any nearby hives.
4. Remember that ground applications are generally less hazardous than aircraft applications and there is usually less drift.
5. When there is a choice, choose the formulation less hazardous to bees. Dusts are more toxic than sprays. EC formulations are less toxic than WP formulations.

Most organophosphate and carbamate insecticides are highly toxic to bees. Insecticides used in field crop production that are toxic to bees are listed below:

Relative Toxicity of Insecticides to Honeybees

Group 1 - Very toxic. Do not apply to flowering crops or weeds.

Ambush	permethrin
Basudin	diazinon
Cygon, Lagon	dimethoate
Guthion	azinphos-methyl
Imidan	phosmet
Lannate	methomyl
Lorsban	chlorpyrifos
Malathion	malathion
Ripcord, Cymbush	cypermethrin
Sniper	azinphos-methyl
Sevin	carbaryl

*Group 2 - Apply only during late evenings or early morning.**

Decis	deltamethrin
Dylox	triclorfon
Endosulfan,Thiodan	endosulfan

*Unusually low temperatures at time of application may cause insecticides to remain toxic up to 20 times longer than during warm weather. High temperatures in the early morning or late evening may extend active foraging by bees.

Relatively Non-Toxic

All the fungicides

Other insecticides listed in this guide can be applied at any time with reasonable safety to bees.

When planning to apply a pesticide, advise local beekeepers so that they can move colonies out of the danger area. your local ministry office or the Provincial Apiarist has a list of the beekeepers in your area.

Pesticide Concentration

Brands of a pesticide from different companies often have different concentrations of the same chemical. If you use one with a concentration different from that listed in this publication, you will need to adjust the rate of application so that you will be applying the same amount of actual chemical (active ingredient).

Seed Treatments

Seed dressings or treatments are poisonous to people and livestock. Do not inhale the fumes or dust when treating or handling treated seed. Wear neoprene or nitrile gloves. Wash all residue of these chemicals from your skin after finishing the treatment. Chemically treated seed is poisonous.

Never feed surplus seed to livestock. Destroy all the bags that have held treated seed as recommended in the container disposal section on page ??

Table 1. Herbicides Used in Ontario (Abbreviations and column headings explained at end of table)

Active Ingredient Names	Examples of TRADE NAMES	Formulation	Guaranteed active concentration	Groups	Winter Storage	Ont. Sch.	Manufacturer/Agent Code
2,4-D	2,4-D *	Sn	470 g/L	4	A	3	*
2,4-D	ESTASOL	EC	564 g/L	4	C	2	RHQ
2,4-D	ESTEMINE 2,4-D	Sn	470 g/L	4	A	3	UAG
2,4-D	ESTER 600	EC	564 g/L	4	C	2	UAG
2,4-D	ESTER 700	EC	660 g/L	4	C	2	INT
2,4-D *	2,4-D	Sn	470 g/L	4	A	3	*
2,4-D/ dicamba/ mecoprop	KIL-MOR	Sn	485 g/L	4	A	2	NOV
2,4-D/ dicamba/ mecoprop	KILLEX 500	Sn	479 g/L	4	A	3	SGF
2,4-D/ dicamba/ mecoprop	KILLEX SUMMER FORMULA	Sn	320 g/L	4	A	3	SGF
2,4-D/ dicamba/ mecoprop	PAR III	Sn	308 g/L	4	A	3	UAG
2,4-D/ dicamba/ mecoprop	PREMIUM 3-WAY TURF HERBICIDE	Sn	308 g/L	4	A	3	INT
2,4-D/ dicamba/ mecoprop	TRICEP	Sn	318 g/L	4	A	3	ZNA
2,4-DB	CALIBER 400	EC	400 g/L	4	B	2	UAG
2,4-DB	COBUTOX 600	EC	600 g/L	4	B	2	INT
2,4-DB	EMBUTOX 625	EC	625 g/L	4	B	2	RHQ
2,4-DB	SEE 2,4-DB	EC	480 g/L	4	B	2	UAG
AATREX	atrazine	Su	480 g/L	5	B	2	NOV
AATREX NINE-O	atrazine	WG	90 %	5	C	2	NOV
ACCENT	nicosulfuron	DF	75 %	2	C	2	DUQ
ACCLAIM SUPER	fenoxaprop-p-ethyl	EC	80.5 g/L	1	A	2	ARV
ACHIEVE 40DG	tralkoxydim	DG	40 %	1	B	3	ZNA
ACHIEVE 80DG	tralkoxydim	DG	80 %	1	B	3	ZNA
acifluorfen	BLAZER	Sn	240 g/L	14	B	2	BAZ
AFESIN	monolinuron	EC	200 g/L	7	D	3	ARV
AFOLAN F	linuron	Su	480 g/L	7	A	3	ARV
AGRICULTURAL WEED KILLER #1	mineral oil (herbicidal)	Li	100 %		C	6	VAR
ALANAP-3	naptalam	Sn	240 g/L	19	A	3	UNR
AMITROL 240	amitrole	SC	231 g/L	11	E	2	NUA
amitrole	AMITROL 240	SC	231 g/L	11	E	2	NUA
amitrole	AMITROL-T	Sn	200 g/L	11	E	3	NUA
AMITROL-T	amitrole	Sn	200 g/L	11	E	3	NUA
AQUASHADE	water soluble dyes	Li	26 %		A	2	APB
ARSENAL	imazapyr	Sn	240 g/L	2	B	2	CYC
ASSURE	quizalofop-ethyl	EC	96 g/L	1	A	2	DUQ
ASSURE II	quizalofop-p-ethyl	EC	96 g/L	1	A	2	DUQ
atrazine	AATREX	Su	480 g/L	5	B	2	NOV
atrazine	AATREX NINE-O	WG	90 %	5	C	2	NOV
atrazine	ATRAZINE 480	Su	480 g/L	5	B	2	UAG

Table 1. Herbicides Used in Ontario (Abbreviations and column headings explained at end of table)

Active Ingredient Names	Examples of TRADE NAMES	Formulation	Guaranteed active concentration	Groups	Winter Storage	Ont. Sch.	Manufacturer/Agent Code
atrazine	ATRAZINE 80W	WP	80 %	5	C	2	*
atrazine	ATRAZINE 90W	WP	90 %	5	C	2	*
atrazine	ATRAZINE 90WG	WG	90 %	5	C	2	UAG
ATRAZINE 480	atrazine	Su	480 g/L	5	B	2	UAG
ATRAZINE 80W	atrazine	WP	80 %	5	C	2	*
ATRAZINE 90W	atrazine	WP	90 %	5	C	2	*
ATRAZINE 90WG	atrazine	WG	90 %	5	C	2	UAG
atrazine/2,4-D	SHOTGUN	Su	390 g/L	4,5	A	2	UAG
AVADEX BW	triallate	EC	400 g/L	8	A	3	MOL
AVENGE 200C	difenzoquat	Sn	200 g/L	8	A	3	CYC
BANVEL II	dicamba	Sn	480 g/L	4	B	2	BAZ
BASAGRAN	bentazon	Sn	480 g/L	6	B	3	BAZ
BASAGRAN FORTE	bentazon	Sn	480 g/L	6	A	3	BAZ
BASAMID	dazomet	Gr	98 %	27	C	2	BAZ
bensulide	BETASAN	EC	480 g/L	8	A	3	NUG
bensulide	BETASAN (GR)	Gr	12.5 %	8	C	3	NUG
bensulide	PREFAR	EC	480g/L	8	A	3	ZNA
bentazon	BASAGRAN	Sn	480 g/L	6	B	3	BAZ
bentazon	BASAGRAN FORTE	Sn	480 g/L	6	A	3	BAZ
bentazon/ atrazine	LADDOK	Su	(1:1) 400 g/L	5,6	A	2	BAZ
BETAMIX	desmedipham/phenmedipham	EC	(1:1) 150 g/L	7	B	2	ARV
BETANEX	desmedipham	EC	150 g/L	7	B	3	ARV
BETASAN	bensulide	EC	480 g/L	8	A	3	NUG
BETASAN (GR)	bensulide	Gr	12.5 %	8	C	3	NUG
BLADEX 90 DF	cyanazine	DF	90 %	5	C	2	DUQ
BLADEX LIQUID	cyanazine	Li	480 g/L	5	B	2	DUQ
BLAZER	acifluorfen	Sn	240 g/L	14	B	2	BAZ
BONANZA 400	trifluralin	EC	400 g/L	3	B	3	UAG
BROADSTRIKE DUAL	flumetsulam/metolachlor	SC	923 g/L	2,15	C	2	DWE
BROADSTRIKE TREFLAN	flumetsulam/trifluralin	SC	438 g/L	2,3	A	2	DWE
bromacil	HYVAR X-L	Sn	240 g/L	5	C	2	DUQ
bromacil/ 2,4-D	CALMIX PELLETS	PE	3 % + 5 %	4,5	C	3	RHQ
bromacil/ diuron	KROVAR	DF	(1:1) 80 %	5,7	C	2	DUQ
bromoxynil	PARDNER	EC	280 g/L	6	C	2	RHQ
bromoxynil	PARDNER GEL	Gl	480 g/L	6	C	2	RHQ
bromoxynil/ MCPA	BUCTRIL M	EC	(1:1) 560 g/L	4,6	C	2	RHQ
bromoxynil/ MCPA	BUCTRIL M GEL	Gl	600 g/L	4,6	C	2	RHQ
BUCTRIL M	bromoxynil/ MCPA	EC	(1:1) 560 g/L	4,6	C	2	RHQ

Table 1. Herbicides Used in Ontario (Abbreviations and column headings explained at end of table)

Active Ingredient Names and Examples of TRADE NAMES		Formulation	Guaranteed active concentration	Groups	Winter Storage	Ont. Sch.	Manufacturer/Agent Code
BUCTRIL M GEL	bromoxynil/ MCPA	Gl	600 g/L	4,6	C	2	RHQ
CALIBER 400	2,4-DB	EC	400 g/L	4	B	2	UAG
CALMIX PELLETS	bromacil/ 2,4-D	PE	3 % + 5 %	4,5	C	3	RHQ
CASORON 4G	dichlobenil	Gr	4 %	20	C	3	UNR
chlorimuron-ethyl	CLASSIC	DF	25 %	2	C	2	DUQ
chlorimuron-ethyl/ thifensulfuron-methyl	RELIANCE STS	DF	(1.75:1) 33 %	2	C	2	DUQ
chlorpropham	CIPC	Gr	20 %	23	C	2	STD
chlorpropham	CIPC EC	EC	480 g/L	23	-	2	STD
chlorpropham	CIPC GR	Gr	10 %	23	C	2	STD
chlorsulfuron	TELAR	DF	75 %	2	C	2	DUQ
CIPC	chlorpropham	Gr	20 %	23	C	2	STD
CIPC EC	chlorpropham	EC	480 g/L	23	-	2	STD
CIPC GR	chlorpropham	Gr	10 %	23	C	2	STD
CLASSIC	chlorimuron-ethyl	DF	25 %	2	C	2	DUQ
CLEAR-IT 1	glyphosate	Sn	7 g/L	9	B	4	MOL
CLEAR-IT 2	glyphosate	Sn	38 g/L	9	B	4	MOL
CLEAR-IT 3	glyphosate	Sn	143 g/L	9	B	4	MOL
clethodim	SELECT	EC	240 g/L	1	C	2	RHQ
clopyralid	LONTREL	Sn	200 g/L	4	A	3	DWE
clopyralid	LONTREL 360	Sn	360 g/L	4	A	2	DWE
clopyralid	TRANSLINE	Sn	360 g/L	4	A	2	DWE
CLOVITOX PLUS	MCPB/MCPA	Sn	375+25	4	A	3	INT
COBUTOX 600	2,4-DB	EC	600 g/L	4	B	2	INT
COMPITOX	mecoprop	Sn	150 g/L	4	A	3	RHQ
CONQUEST [1]	imazethapyr + metribuzin	WG	70% + 75%	2,5	C	2	CYC
copper ethanolamine	CUTRINE PLUS	Sn	9 %		A	2	APB
copper ethanolamine	CUTRINE PLUS (GRANULAR)	Gr	3.7 %		B	2	APB
CUTRINE PLUS	copper ethanolamine	Sn	9 %		A	2	APB
CUTRINE PLUS (GRANULAR)	copper ethanolamine	Gr	3.7 %		B	2	APB
cyanazine	BLADEX 90 DF	DF	90 %	5	C	2	DUQ
cyanazine	BLADEX LIQUID	Li	480 g/L	5	B	2	DUQ
cycloate	RO-NEET	EC	720 g/L	8	C	3	ZNA
dazomet	BASAMID	Gr	98 %	27	C	2	BAZ
desmedipham	BETANEX	EC	150 g/L	7	B	3	ARV
desmedipham/phenmedipham	BETAMIX	EC	(1:1) 150 g/L	7	B	2	ARV
DEVRINOL 10G	napropamide	Gr	10 %	15	C	3	UAG
DEVRINOL 50W	napropamide	WP	50 %	15	C	3	UAG
DEVRINOL DF	napropamide	DF	50 DF	15	C	3	UAG

Table 1. Herbicides Used in Ontario (Abbreviations and column headings explained at end of table)

Active Ingredient Names	Examples of TRADE NAMES	Formulation	Guaranteed active concentration	Groups	Winter Storage	Ont. Sch.	Manufacturer/Agent Code
dicamba	BANVEL II	Sn	480 g/L	4	B	2	BAZ
dicamba	DYCLEER	Sn	480 g/L	4	B	2	NOV
dicamba/ atrazine	MARKSMAN	Fl	(1:2) 401 g/L	4,5	B	2	BAZ
dicamba/ MCPA	DYVEL	Sn	(1:4) 420 g/L	4	B	2	BAZ
dicamba/ MCPA/ mecoprop	TARGET	Sn	400 g/L	4	A	3	NOV
dichlobenil	CASORON 4G	Gr	4 %	20	C	3	UNR
dichlorprop/ 2,4-D	DICHLORPROP D	EC	(1:1) 582 g/L	4	B	2	INT
dichlorprop/ 2,4-D	DIPHENOPROP BK 700	EC	679 g/L	4	B	2	UAG
dichlorprop/ 2,4-D	DIPHENOPROP, SEE	EC	(1:1) 444 g/L	4	B	2	UAG
dichlorprop/ 2,4-D	ESTAPROP	EC	582 g/L	4	B	2	RHQ
dichlorprop/ 2,4-D	WEEDONE CB	Sn	(1:1) 160 g/L	4	C	2	RHQ
DICHLORPROP D	dichlorprop/ 2,4-D	EC	(1:1) 582 g/L	4	B	2	INT
diclofop-methyl	HOE-GRASS 284	EC	284 g/L	1	A	3	ARV
difenzoquat	AVENGE 200C	Sn	200 g/L	8	A	3	CYC
diflufenzopyr/dicamba	DISTINCT	WG	70 %	4,19	C	2	BAZ
DIMENSION	dithiopyr	EC	120 g/L	3	B	2	ROH
dimethenamid	FRONTIER	EC	900 g/L	15	A	3	BAZ
DIPHENOPROP BK 700	dichlorprop/ 2,4-D	EC	679 g/L	4	B	2	UAG
DIPHENOPROP, SEE	dichlorprop/ 2,4-D	EC	(1:1) 444 g/L	4	B	2	UAG
diquat	REGLONE	Li	200 g/L	22	A	3	ZNA
diquat	REGLONE PRO	Li	200 g/L	22	A	3	ZNA
diquat (aquatic)	REGLONE A	Li	200 g/L	22	A	2	ZNA
DISTINCT	diflufenzopyr/dicamba	WG	70 %	4,19	C	2	BAZ
dithiopyr	DIMENSION	EC	120 g/L	3	B	2	ROH
diuron	KARMEX	DF	80 %	7	C	2	GRN
DUAL	metolachlor	EC	960 g/L	15	B	2	NOV
DUAL II	metolachlor/benoxacor	EC	935 g/L	15	B	2	NOV
DUAL II MAGNUM	s-metolachlor/benoxacor	EC	915 g/L	15	B	2	NOV
DUAL MAGNUM	s-metolachlor	EC	915 g/L	15	B	2	NOV
DYCLEER	dicamba	Sn	480 g/L	4	B	2	NOV
DYVEL	dicamba/ MCPA	Sn	(1:4) 420 g/L	4	B	2	BAZ
EDGE	ethalfluralin	DC	60 %	3	A	3	DWE
ELIM EP	rimsulfuron	DF	25 %	2	C	2	DUQ
EMBUTOX 625	2,4-DB	EC	625 g/L	4	B	2	RHQ
endothall	HERBICIDE 273	Sn	360 g/L		A	2	EFA
EPTAM	EPTC	EC	800 g/L	8	C	3	ZNA
EPTC	EPTAM	EC	800 g/L	8	C	3	ZNA
EPTC/ R25788 (EPTC+)	ERADICANE	EC	800 g/L	8	C	2	ZNA

Table 1. Herbicides Used in Ontario (Abbreviations and column headings explained at end of table)

Active Ingredient Names and Examples of TRADE NAMES		Formulation	Guaranteed active concentration	Groups	Winter Storage	Ont. Sch.	Manufacturer/Agent Code
ERADICANE	EPTC/ R25788 (EPTC+)	EC	800 g/L	8	C	2	ZNA
ESTAPROP	dichlorprop/ 2,4-D	EC	582 g/L	4	B	2	RHQ
ESTASOL	2,4-D	EC	564 g/L	4	C	2	RHQ
ESTEMINE 2,4-D	2,4-D	Sn	470 g/L	4	A	3	UAG
ESTEMINE MCPA	MCPA	Sn	500 g/L	4	A	3	UAG
ESTER 600	2,4-D	EC	564 g/L	4	C	2	UAG
ESTER 700	2,4-D	EC	660 g/L	4	C	2	INT
ethalfluralin	EDGE	DC	60 %	3	A	3	DWE
ethametsulfuron-methyl	MUSTER	DF	75 %	2	C	5	DUQ
ethofumesate	NORTRON SC	Su	480 g/L	16	A	2	ARV
EXCEL SUPER	fenoxaprop-p-ethyl	EC	80.5 g/L	1	A	2	ARV
EXPEDITE BROADLEAF	mecoprop/ 2,4-D	Sn	(1:2) 186 g/L	4	A	2	PLG
EXPEDITE GRASS & WEED	glyphosate	Sn	147 g/L	9	A	3	MOL
EZJECT	glyphosate	P	0.15 g/capsule	9	C	3	MOL
fenoxaprop-p-ethyl	ACCLAIM SUPER	EC	80.5 g/L	1	A	2	ARV
fenoxaprop-p-ethyl	EXCEL SUPER	EC	80.5 g/L	1	A	2	ARV
FIELDSTAR	flumetsulam/clopyralid	WG	(1:2.7) 85.6 %	2,4	C	2	DWE
fluazifop-p-butyl	FUSILADE II	EC	125 g/L	1	C	5	ZNA
fluazifop-p-butyl	VENTURE 25G	DG	25 %	1	C	2	ZNA
flumetsulam/clopyralid	FIELDSTAR	WG	(1:2.7) 85.6 %	2,4	C	2	DWE
flumetsulam/clopyralid/2,4-D	STRIKER	WG	(1:2.7:5.4) 84.3 %	2,4	C	2	DWE
flumetsulam/metolachlor	BROADSTRIKE DUAL	SC	923 g/L	2,15	C	2	DWE
flumetsulam/trifluralin	BROADSTRIKE TREFLAN	SC	438 g/L	2,3	A	2	DWE
fomesafen	REFLEX	Sn	240 g/L	14	B	2	ZNA
fosamine ammonium	KRENITE	Sn	480 g/L	27	B	3	DUQ
FRONTIER	dimethenamid	EC	900 g/L	15	A	3	BAZ
FUSILADE II	fluazifop-p-butyl	EC	125 g/L	1	C	5	ZNA
GALLERY	isoxaben	DF	75 %	21	C	2	DWE
GARLON 4	triclopyr	EC	480 g/L	4	B	2	DWE
GESAGARD 480 SC	prometryne	Su	480 g/L	5	B	2	NOV
glufosinate ammonium	IGNITE	Sn	150 g/L	10	A	3	ARV
glufosinate ammonium	LIBERTY 200SN	Sn	200 g/L	10	A	3	ARV
GLYFOS	glyphosate	Sn	360 g/L	9	B	6	CAU
glyphosate	CLEAR-IT 1	Sn	7 g/L	9	B	4	MOL
glyphosate	CLEAR-IT 2	Sn	38 g/L	9	B	4	MOL
glyphosate	CLEAR-IT 3	Sn	143 g/L	9	B	4	MOL
glyphosate	EXPEDITE GRASS & WEED	Sn	147 g/L	9	A	3	MOL
glyphosate	EZJECT	P	0.15 g/capsule	9	C	3	MOL

Table 1. Herbicides Used in Ontario (Abbreviations and column headings explained at end of table)

Active Ingredient Names	Examples of TRADE NAMES	Formulation	Guaranteed active concentration	Groups	Winter Storage	Ont. Sch.	Manufacturer/Agent Code
glyphosate	GLYFOS	Sn	360 g/L	9	B	6	CAU
glyphosate	LAREDO	Sn	356 g/L	9	B	3	MOL
glyphosate	RENEGADE	Sn	356 g/L	9	B	3	MOL
glyphosate	ROUNDUP	Sn	356 g/L	9	B	3	MOL
glyphosate	ROUNDUP DRY	SG	64 %	9	C	3	MOL
glyphosate	ROUNDUP L & G	Sn	assorted	9	B	4	MOL
glyphosate	ROUNDUP TRANSORB	Sn	360 g/L	9	B	3	MOL
glyphosate	VISION	Sn	356 g/L	9	B	2	MOL
glyphosate	WRANGLER	Sn	356 g/L	9	B	3	MOL
glyphosate TMS	TOUCHDOWN 480	Sn	330 g/L	9	B	6	ZNA
glyphosate/glufosinate ammonium	ROUNDUP FASTFORWARD PREHARVEST	Sn	(18.75:1) 316 g/L	9,10	B	3	MOL
glyphosate/glufosinate ammonium	ROUNDUP FASTFORWARD PRESEED	Sn	(30:1) 310 g/L	9,10	B	3	MOL
GOAL 2XL	oxyfluorfen	EC	240 g/L	14	A	1	ROH
GRAMOXONE	paraquat	Sn	200 g/L	22	A	2	ZNA
HERBICIDE 273	endothall	Sn	360 g/L		A	2	EFA
hexazinone	PRONONE	Gr	10 %	5	C	3	DUQ
hexazinone	VELPAR	SP	75 %	5	C	2	DUQ
HOE-GRASS 284	diclofop-methyl	EC	284 g/L	1	A	3	ARV
HYVAR X-L	bromacil	Sn	240 g/L	5	C	2	DUQ
IGNITE	glufosinate ammonium	Sn	150 g/L	10	A	3	ARV
imazamox + fomesafen	VIPER [1]	WG+Sn	70 % + 240 g/L	2,14	C	2	CYC
imazapyr	ARSENAL	Sn	240 g/L	2	B	2	CYC
imazethapyr	PURSUIT	Sn	240 g/L	2	A	2	CYC
imazethapyr/atrazine	PATRIOT	SC	405 g/L	2,5	A	2	CYC
imazethapyr + metribuzin	CONQUEST [1]	WG+WG	70% + 75%	2,5	C	2	CYC
imazethapyr/pendimethalin	VALOR	EC	(1:14.5) 342 g/L	2,3	A	5	CYC
isoxaben	GALLERY	DF	75 %	21	C	2	DWE
KARMEX	diuron	DF	80 %	7	C	2	GRN
KERB	propyzamide	WP	50 %	15	C	3	ROH
KILLEX 500	2,4-D/ dicamba/ mecoprop	Sn	479 g/L	4	A	3	SGF
KILLEX SUMMER FORMULA	2,4-D/ dicamba/ mecoprop	Sn	320 g/L	4	A	3	SGF
KIL-MOR	2,4-D/ dicamba/ mecoprop	Sn	485 g/L	4	A	2	NOV
KRENITE	fosamine ammonium	Sn	480 g/L	27	B	3	DUQ
KROVAR	bromacil/ diuron	DF	(1:1) 80 %	5,7	C	2	DUQ
LADDOK	bentazon/ atrazine	Su	(1:1) 400 g/L	5,6	A	2	BAZ
LAREDO	glyphosate	Sn	356 g/L	9	B	3	MOL
LENTAGRAN	pyridate	WP	45 %	6	A	3	NOV

Table 1. Herbicides Used in Ontario (Abbreviations and column headings explained at end of table)

Active Ingredient Names and Examples of TRADE NAMES		Formulation	Guaranteed active concentration	Groups	Winter Storage	Ont. Sch.	Manufacturer/Agent Code
LEXONE DF	metribuzin	DF	75 %	5	C	2	DUQ
LIBERTY 200SN	glufosinate ammonium	Sn	200 g/L	10	A	3	ARV
linuron	AFOLAN F	Su	480 g/L	7	A	3	ARV
linuron	LINURON 480	Su	480 g/L	7	A	3	UAG
linuron	LOROX DF	DF	50 %	7	C	3	GRN
linuron	LOROX L	Su	480 g/L	7	A	3	GRN
LINURON 480	linuron	Su	480 g/L	7	A	3	UAG
LONTREL	clopyralid	Sn	200 g/L	4	A	3	DWE
LONTREL 360	clopyralid	Sn	360 g/L	4	A	2	DWE
LOROX DF	linuron	DF	50 %	7	C	3	GRN
LOROX L	linuron	Su	480 g/L	7	A	3	GRN
maleic hydrazide	ROYAL MH 60 SG	SG	60 %		C	3	UNR
MARKSMAN	dicamba/ atrazine	Fl	(1:2) 401 g/L	4,5	B	2	BAZ
MCPA	ESTEMINE MCPA	Sn	500 g/L	4	A	3	UAG
MCPA	MCPA AMINE	Sn	500 g/L	4	A	3	*
MCPA	MCPA ESTER	Sn	500 g/L	4	B	1	*
MCPA	MCPA SODIUM 300	Sn	300 g/L	4	A	3	*
MCPA AMINE	MCPA	Sn	500 g/L	4	A	3	*
MCPA ESTER	MCPA	Sn	500 g/L	4	B	1	*
MCPA SODIUM 300	MCPA	Sn	300 g/L	4	A	3	*
MCPB/MCPA	CLOVITOX PLUS	Sn	375+25	4	A	3	INT
MCPB/MCPA	TROPOTOX PLUS	Sn	400 g/L	4	A	3	RHQ
MECO-D	mecoprop/ 2,4-D	Sn	(1:1.9) 435 g/L	4	A	3	SGF
mecoprop	COMPITOX	Sn	150 g/L	4	A	3	RHQ
mecoprop	MECOPROP	Sn	150 g/L	4	A	3	UAG
mecoprop	MECOPROP	Sn	assorted	4	A	3	*
MECOPROP	mecoprop	Sn	assorted	4	A	3	*
MECOPROP	mecoprop	Sn	150 g/L	4	A	3	UAG
MECOPROP PLUS 2,4-D	mecoprop/ 2,4-D	Sn	(0.9:1) 194 g/L	4	A	3	UAG
mecoprop/ 2,4-D	EXPEDITE BROADLEAF	Sn	(1:2) 186 g/L	4	A	2	PLG
mecoprop/ 2,4-D	MECO-D	Sn	(1:1.9) 435 g/L	4	A	3	SGF
mecoprop/ 2,4-D	MECOPROP PLUS 2,4-D	Sn	(0.9:1) 194 g/L	4	A	3	UAG
mecoprop/ 2,4-D	MECOTURF PLUS 2,4-D	Sn	(1:1) 400 g/L	4	A	3	RHQ
mecoprop/ 2,4-D	PREMIUM 2-WAY TURF HERBICIDE	Sn	(1:1) 400 g/L	4	A	3	INT
mecoprop/ 2,4-D	TURF-RITE 2+2	Sn	(1:1) 400 g/L	4	A	3	SAF
MECOTURF PLUS 2,4-D	mecoprop/ 2,4-D	Sn	(1:1) 400 g/L	4	A	3	RHQ
metam sodium	VAPAM	Sn	380 g/L	27	C	3	UAG
methyl bromide/ chloropicrin	TERR-O-GAS 67	Li	67% + 31%		-	1	GRC

Table 1. Herbicides Used in Ontario (Abbreviations and column headings explained at end of table)

methyl isothiocyanate/ dichloropropene	VORLEX PLUS	Li	203 g + 373 g/L		B	2	ARV
methyl isothiocyanate/ dichloropropene/ chloropicrin	VORLEX PLUS CP	Li	185 g + 370 g + 163 g/L		B	2	ARV
metobromuron	PATORAN FL	Su	400 g/L	7	A	2	NOV
metolachlor	DUAL	EC	960 g/L	15	B	2	NOV
metolachlor/ atrazine	PRIMEXTRA LIGHT	Su	(2:1) 500 g/L	5,15	B	2	NOV
metolachlor/benoxacor	DUAL II	EC	935 g/L	15	B	2	NOV
metribuzin	LEXONE DF	DF	75 %	5	C	2	DUQ
metribuzin	SENCOR 500 F	Su	500 g/L	5	C	2	BBB
metribuzin	SENCOR 75 DF	WG	75 %	5	C	2	BBB
metribuzin	SENCOR SOLUPAK	WG	75 %	5	C	2	BBB
mineral oil (herbicidal)	AGRICULTURAL WEED KILLER #1	Li	100 %		C	6	VAR
monolinuron	AFESIN	EC	200 g/L	7	D	3	ARV
MUSTER	ethametsulfuron-methyl	DF	75 %	2	C	5	DUQ
napropamide	DEVRINOL 10G	Gr	10 %	15	C	3	UAG
napropamide	DEVRINOL 50W	WP	50 %	15	C	3	UAG
napropamide	DEVRINOL DF	DF	50 DF	15	C	3	UAG
naptalam	ALANAP-3	Sn	240 g/L	19	A	3	UNR
nicosulfuron	ACCENT	DF	75 %	2	C	2	DUQ
nicosulfuron/rimsulfuron	ULTIM DF	DF	(1:1) 37.4 %	2	C	2	DUQ
nicosulfuron/rimsulfuron + flumetsulam/clopyralid/2,4-D	ULTIMAX [1]	WG+WG	37.4% + 84.3%	2,4	C	2	DUQ
NORTRON SC	ethofumesate	Su	480 g/L	16	A	2	ARV
oxadiazon	RONSTAR 2G	Gr	2 %	14	C	2	RHQ
oxyfluorfen	GOAL 2XL	EC	240 g/L	14	A	1	ROH
PAR III	2,4-D/ dicamba/ mecoprop	Sn	308 g/L	4	A	3	UAG
paraquat	GRAMOXONE	Sn	200 g/L	22	A	2	ZNA
paraquat/ diquat	WEED AND GRASS KILLER	SG	(1:1) 5 %	22	C	3	NUG
PARDNER	bromoxynil	EC	280 g/L	6	C	2	RHQ
PARDNER GEL	bromoxynil	Gl	480 g/L	6	C	2	RHQ
PATORAN FL	metobromuron	Su	400 g/L	7	A	2	NOV
PATRIOT	imazethapyr/atrazine	SC	405 g/L	2,5	A	2	CYC
PEAKPLUS [1]	prosulfuron + dicamba	WG+Sn	75 % + 480 g/L	2,4	C	2	NOV
pendimethalin	PROWL 400	EC	400 g/L	3	A	5	CYC
phenmedipham	SPIN-AID	EC	150 g/L	7	C	3	ARV
picloram/ 2,4-D	TORDON 101	Sn	(1:3.7) 305 g/L	4	A	2	DWE
PINNACLE	thifensulfuron- methyl	DF	75 %	2	C	3	DUQ
POAST ULTRA	sethoxydim	EC	450 g/L	1	B	3	BAZ

Table 1. Herbicides Used in Ontario (Abbreviations and column headings explained at end of table)

PREFAR	bensulide	EC	480g/L	8	A	3	ZNA
PREMIUM 2-WAY TURF HERBICIDE	mecoprop/ 2,4-D	Sn	(1:1) 400 g/L	4	A	3	INT
PREMIUM 3-WAY TURF HERBICIDE	2,4-D/ dicamba/ mecoprop	Sn	308 g/L	4	A	3	INT
PRIMEXTRA II MAGNUM	s-metolachlor/benoxacor/atrazine	SC	(1:0.8) 720 g/L	5,15	B	2	NOV
PRIMEXTRA LIGHT	metolachlor/ atrazine	Su	(2:1) 500 g/L	5,15	B	2	NOV
PRINCEP NINE-T	simazine	WG	90 %	5	C	2	NOV
PRISM	rimsulfuron	DF	25 %	2	C	2	DUQ
prometryne	GESAGARD 480 SC	Su	480 g/L	5	B	2	NOV
PRONONE	hexazinone	Gr	10 %	5	C	3	DUQ
propanil/ MCPA	STAMPEDE CM	EC	(3.6:1) 460 g/L	4,7	B	2	ROH
propyzamide	KERB	WP	50 %	15	C	3	ROH
prosulfuron + dicamba	PEAKPLUS [1]	WG+Sn	75 % + 480 g/L	2,4	C	2	NOV
PROWL 400	pendimethalin	EC	400 g/L	3	A	5	CYC
PURSUIT	imazethapyr	Sn	240 g/L	2	A	2	CYC
PYRAMIN FL	pyrazon	Su	430 g/L	5	B	3	BAZ
pyrazon	PYRAMIN FL	Su	430 g/L	5	B	3	BAZ
pyridate	LENTAGRAN	WP	45 %	6	A	3	NOV
quizalofop-ethyl	ASSURE	EC	96 g/L	1	A	2	DUQ
quizalofop-p-ethyl	ASSURE II	EC	96 g/L	1	A	2	DUQ
REFINE EXTRA	thifensulfuron-methyl/ tribenuron-methyl	DF	(2:1) 75 %	2	C	2	DUQ
REFLEX	fomesafen	Sn	240 g/L	14	B	2	ZNA
REGLONE	diquat	Li	200 g/L	22	A	3	ZNA
REGLONE A	diquat (aquatic)	Li	200 g/L	22	A	2	ZNA
REGLONE PRO	diquat	Li	200 g/L	22	A	3	ZNA
RELEASE	triclopyr	EC	480 g/L	4	B	2	DWE
RELIANCE STS	chlorimuron-ethyl/ thifensulfuron-methyl	DF	(1.75:1) 33 %	2	C	2	DUQ
RENEGADE	glyphosate	Sn	356 g/L	9	B	3	MOL
rimsulfuron	ELIM EP	DF	25 %	2	C	2	DUQ
rimsulfuron	PRISM	DF	25 %	2	C	2	DUQ
RIVAL	trifluralin	EC	500 g/L	3	A	3	ARV
RIVAL DF	trifluralin	DF	60 %	3	C	2	ARV
RO-NEET	cycloate	EC	720 g/L	8	C	3	ZNA
RONSTAR 2G	oxadiazon	Gr	2 %	14	C	2	RHQ
ROUNDUP	glyphosate	Sn	356 g/L	9	B	3	MOL
ROUNDUP DRY	glyphosate	SG	64 %	9	C	3	MOL
ROUNDUP FASTFORWARD PREHARVEST	glyphosate/glufosinate ammonium	Sn	(18.75:1) 316 g/L	9,10	B	3	MOL
ROUNDUP FASTFORWARD PRESEED	glyphosate/glufosinate ammonium	Sn	(30:1) 310 g/L	9,10	B	3	MOL
ROUNDUP L & G	glyphosate	Sn	assorted	9	B	4	MOL

Table 1. Herbicides Used in Ontario (Abbreviations and column headings explained at end of table)

Active Ingredient Names and Examples of TRADE NAMES		Formulation	Guaranteed active concentration	Groups	Winter Storage	Ont. Sch.	Manufacturer/Agent Code
ROUNDUP TRANSORB	glyphosate	Sn	360 g/L	9	B	3	MOL
ROYAL MH 60 SG	maleic hydrazide	SG	60 %		C	3	UNR
SEE 2,4-DB	2,4-DB	EC	480 g/L	4	B	2	UAG
SELECT	clethodim	EC	240 g/L	1	C	2	RHQ
SENCOR 500 F	metribuzin	Su	500 g/L	5	C	2	BBB
SENCOR 75 DF	metribuzin	WG	75 %	5	C	2	BBB
SENCOR SOLUPAK	metribuzin	WG	75 %	5	C	2	BBB
sethoxydim	POAST ULTRA	EC	450 g/L	1	B	3	BAZ
SHOTGUN	atrazine/2,4-D	Su	390 g/L	4,5	A	2	UAG
SIMADEX	simazine	Su	500 g/L	5	A	2	ARV
simazine	PRINCEP NINE-T	WG	90 %	5	C	2	NOV
simazine	SIMADEX	Su	500 g/L	5	A	2	ARV
simazine	SIMAZINE 480	Su	480 g/L	5	A	2	UAG
simazine	SIMAZINE 80W	WP	80 %	5	C	2	UAG
SIMAZINE 480	simazine	Su	480 g/L	5	A	2	UAG
SIMAZINE 80W	simazine	WP	80 %	5	C	2	UAG
SINBAR	terbacil	WP	80 %	5	C	2	DUQ
s-metolachlor	DUAL MAGNUM	EC	915 g/L	15	B	2	NOV
s-metolachlor/benoxacor	DUAL II MAGNUM	EC	915 g/L	15	B	2	NOV
s-metolachlor/benoxacor/atrazine	PRIMEXTRA II MAGNUM	SC	(1:0.8) 720 g/L	5,15	B	2	NOV
SPIN-AID	phenmedipham	EC	150 g/L	7	C	3	ARV
STAMPEDE CM	propanil/ MCPA	EC	(3.6:1) 460 g/L	4,7	B	2	ROH
STRIKER	flumetsulam/clopyralid/2,4-D	WG	(1:2.7:5.4) 84.3 %	2,4	C	2	DWE
TARGET	dicamba/ MCPA/ mecoprop	Sn	400 g/L	4	A	3	NOV
TELAR	chlorsulfuron	DF	75 %	2	C	2	DUQ
terbacil	SINBAR	WP	80 %	5	C	2	DUQ
TERR-O-GAS 67	methyl bromide/ chloropicrin	Li	67% + 31%		-	1	GRC
thifensulfuron- methyl	PINNACLE	DF	75 %	2	C	3	DUQ
thifensulfuron-methyl/ tribenuron-methyl	REFINE EXTRA	DF	(2:1) 75 %	2	C	2	DUQ
TORDON 101	picloram/ 2,4-D	Sn	(1:3.7) 305 g/L	4	A	2	DWE
TOUCHDOWN 480	glyphosate TMS	Sn	330 g/L	9	B	6	ZNA
tralkoxydim	ACHIEVE 40DG	DG	40 %	1	B	3	ZNA
tralkoxydim	ACHIEVE 80DG	DG	80 %	1	B	3	ZNA
TRANSLINE	clopyralid	Sn	360 g/L	4	A	2	DWE
TREFLAN	trifluralin	EC	545 g/L	3	B	3	DWE
TREFLAN EC	trifluralin	EC	480 g/L	3	A	3	DWE
triallate	AVADEX BW	EC	400 g/L	8	A	3	MOL
TRICEP	2,4-D/ dicamba/ mecoprop	Sn	318 g/L	4	A	3	ZNA

Table 1. Herbicides Used in Ontario (Abbreviations and column headings explained at end of table)

Active Ingredient Names and Examples of TRADE NAMES		Formulation	Guaranteed active concentration	Groups	Winter Storage	Ont. Sch.	Manufacturer/Agent Code
triclopyr	GARLON 4	EC	480 g/L	4	B	2	DWE
triclopyr	RELEASE	EC	480 g/L	4	B	2	DWE
trifluralin	BONANZA 400	EC	400 g/L	3	B	3	UAG
trifluralin	RIVAL	EC	500 g/L	3	A	3	ARV
trifluralin	RIVAL DF	DF	60 %	3	C	2	ARV
trifluralin	TREFLAN	EC	545 g/L	3	B	3	DWE
trifluralin	TREFLAN EC	EC	480 g/L	3	A	3	DWE
triflusulfuron-methyl	UPBEET	DF	50 %	2	C	2	DUQ
TROPOTOX PLUS	MCPB/MCPA	Sn	400 g/L	4	A	3	RHQ
TURF-RITE 2+2	mecoprop/ 2,4-D	Sn	(1:1) 400 g/L	4	A	3	SAF
ULTIM DF	nicosulfuron/rimsulfuron	DF	(1:1) 37.4 %	2	C	2	DUQ
ULTIMAX [1]	nicosulfuron/rimsulfuron + flumetsulam/clopyralid/2,4-D	WG+WG	37.4% + 84.3%	2,4	C	2	DUQ
UPBEET	triflusulfuron-methyl	DF	50 %	2	C	2	DUQ
VALOR	imazethapyr/pendimethalin	EC	(1:14.5) 342 g/L	2,3	A	5	CYC
VAPAM	metam sodium	Sn	380 g/L	27	C	3	UAG
VELPAR	hexazinone	SP	75 %	5	C	2	DUQ
VENTURE 25G	fluazifop-p-butyl	DG	25 %	1	C	2	ZNA
VIPER [1]	imazamox + fomesafen	WG+Sn	70 % + 240 g/L	2,14	C	2	CYC
VISION	glyphosate	Sn	356 g/L	9	B	2	MOL
VORLEX PLUS	methyl isothiocyanate/ dichloropropene	Li	203 g + 373 g/L		B	2	ARV
VORLEX PLUS CP	methyl isothiocyanate/ dichloropropene/ chloropicrin	Li	185 g + 370 g + 163 g/L		B	2	ARV
water soluble dyes	AQUASHADE	Li	26 %		A	2	APB
WEED AND GRASS KILLER	paraquat/ diquat	SG	(1:1) 5 %	22	C	3	NUG
WEEDONE CB	dichlorprop/ 2,4-D	Sn	(1:1) 160 g/L	4	C	2	RHQ
WRANGLER	glyphosate	Sn	356 g/L	9	B	3	MOL

Table 2. Adjuvants Used in Ontario

AGRAL 90	non-ionic surfactant	nonylphenoxy polyethyoxyethanol	90%	2	C	NOR
AG-SURF	non-ionic surfactant	nonylphenoxy polyethyoxyethanol	92%	2	C	INT
AMIGO	surfactant	phosphate ester	30	2	C	RHQ
BASF LIQUID AMMONIUM SULPHATE	liquid fertilizer	ammonium sulphate	490 g/L	6	A	BAZ
ASSIST OIL CONCENTRATE	mineral oil/surfactant (non herbicidal)	paraffin base mineral oil + surfactant blend	83% + 17%	3	C	BAZ
CANPLUS 411	mineral oil/surfactant (non herbicidal)	paraffin base mineral oil + surfactant blend	83% + 17%	6	C	ATC
CHARGE	mineral oil/surfactant (non herbicidal)	paraffin base mineral oil + surfactant blend	83% + 17%	6	C	ZNA
CITOWETT PLUS	non-ionic spreader sticker surfactant	ocylphenoxy-polyethoxy ethanol	50%	3	C	BAZ
COMPANION	non-ionic surfactant	ocylphenoxy-polyethoxy-(9) ethanol	70%	3	C	ROH
CO-OP EMULSIFIABLE SPRAY OIL	mineral oil (non herbicidal)	mineral oil + emulsifier	98.5% + 1.5%	3		INT
CORN OIL	mineral oil (non herbicidal)	paraffin base mineral oil + surfactant blend	98.8% + 1.2%		C	UAG
ENHANCE	cationic surfactant with non-ionic component	tallow fatty acid amine ethoxylate and nonylphenoxy-polyethoxy ethanol	780 g/L	2	A	DWE
FIGHTER F	antifoamer/defoamer	dimethylpolysiloxane		3		UAG
HALT	defoamer	silicone base, neutral	30%		A	DWE
IPCO OIL CONCENTRATE	mineral oil (non herbicidal)	paraffin base mineral oil + surfactant blend	83% + 17%	3	C	INT
KORNOIL	mineral oil (non herbicidal)	mineral oil + emulsifier	98.5% + 1.5%	3	C	VAR
KORNOIL CONCENTRATE	mineral oil/surfactant (non herbicidal)	paraffin base mineral oil + surfactant blend	85% + 15%	3	C	VAR
LI700	non-ionic surfactant & pH adjuster acidifier	phosphatidylcholine, methylacetic acid, alky polyoxyethylene ether	80%	3	C	UAG
MERGE	surfactant/solvent	surfactant blend + solvent (petroleum hydrocarbons)	50% + 50%	3	B	BAZ
NALCO-TROL	drift control agent	polyvinyl polymer	30%	3		NLC
SIDEKICK	non-ionic liquid spreader/activator	alkylarylpolyoxyethylene glycols, free fatty acids & isopropyl alcohol	900 g/L	3	C	NOR
SPRAY ADJUVANT DEFOAMER	defoamer	demethylpoly-silozane				

Table 2. Adjuvants Used in Ontario

[illegible]	Type of Adjuvant	Chemical Composition	[illegible]	[illegible]	[illegible]	[illegible]
SPRAYCO PREMIUM MINERAL OIL	mineral oil (non herbicidal)	mineral oil + emulsifier	98.5% + 1.5%	6	C	SWC
SPRAYCO OIL CONCENTRATE	mineral oil/surfactant (non herbicidal)	paraffin base mineral oil + surfactant blend	85% + 15%	6	C	SWC
SUPER SPREADER STICKER	non-ionic spreader sticker surfactant	ocylphenoxy-polyethoxy ethanol	50%	3	C	UAG
SUPERIOR OIL CONCENTRATE	mineral oil (non herbicidal)	paraffin base mineral oil + surfactant blend	83% + 17%	6		BAT, RHQ, UAP
SURE-MIX	petroleum oil/ surfactant (non-herbicidal)	paraffinic petroleum oil + surfactant blend	60% + 35.6%	6	A	DUQ
SURF 92	non-ionic surfactant	nonylphenoxy polyethyoxyethanol	92%	2	C	WBR
SYLGARD 309	organosilicone, non-ionic	silicone polyether	76%	3	C	DCS
TURBOCHARGE	mineral oil/surfactant (non herbicidal)	paraffin base mineral oil + surfactant blend	50% + 39.5%	3	C	ZNA
38-F	drift retardant	polyacrylamide	82%	3	C	UAG

Mention of a Brand or Trade name in this table does not constitute a guarantee or warranty of the product by the Ontario Weed Committee. Neither does this use signify that these products are approved to the exclusion of comparable products. All trade names are capitalized.

Table 1 and 2. Footnotes and Endnotes

Mention of a Brand or Trade name in this table does no constitute a guarantee or warrantee of the product by the Ontario Weed Committee. Neither does this use signify that that these products are approved to the exclusion of the comparable products. All trade names are capitalized.

* Various manufacturers.
1 indicates herbicides sold as a co-pack under this Trade name

Formulation Abbreviations

DC = dispersible concentrate	EM = emulsion	Li = liquid	SC = soluble concentrate	WG = wettable granules
DF = dry flowable	Fl = flowable	P = paste	SG = soluble granuals	WP = wettable powder
DG = dry granuls	Gi = gel	PE = pellets	Sn = solution	Su = suspension (flowable)
EC = emulsifiable concentrate	Gr = granular	PS = pressurized spray	SP = soluble powder	

Winter Storage

A - Do not allow to freeze.
B - Preferably should not freeze. If frozen, return to original state by allowing product to warm to 10-20oC and agitate thoroughly before use.
C - Not usually damaged by freezing. Store in a cool, dry place.
D -Do not allow to freeze - store above 10 C (this applies to AFESIN)
E - Do not allow to freeze - store above 4 C (this applies to the AMITROL T and 240)
READ STORAGE SECTION IN THE FRONT OF THIS PUBLICATION

Criteria for Ontario Classification of Pesticide Products

Sch.	Pesticide Category	Criteria	Sales Outlet	Used By
1	Restricted	Extremely Toxic, Very Highly Persistent	Licensed, Record of Sale	Licensed Applicator, Certified Agriculturist, under Permit Approval
5	Agriculture	Extremely Toxic, Very Highly Persistent	Licensed, Record of Sale	Same as Schedule 1 except no permit if Certified Agriculturist or Licensed Applicator
2	Pest Control Industry and Agriculture	Very Toxic, Highly Persistent	Licensed, Record of Sale	Licensed Applicator or Certified Agriculturist
3	Consumer, Pest Control Industry and Agriculture	Moderately Toxic, Moderately Persistent	Licensed	Homeowner, Licensed Applicator and Agriculturist
4	Consumer, Pest Control Industry and Agriculture	Slightly Toxic	No License Required	Homeowner, Licensed Applicator and Agriculturist
6	Consumer, Pest Control Industry, Commercial and Agriculture	Slightly Toxic	Licensed (same as Schedule 4 except larger container)	Homeowner, Licensed Applicator and Agriculturist

Notes on Chemicals

Introduction

These notes should be considered with the recommendations given later in this publication. Additional information on use, toxicity and safety precautions is given here. With a few exceptions the chemicals are listed under their common (generic) rather than their trade or product name. See *Table 1* to determine the corresponding common name for a particular trade name. For example, *Table 1* indicates that the trade name AATREX has a common name of atrazine; notes on AATREX will be listed under atrazine in this section.

2,4-D

Trade Names: 2,4-D AMINE, ESTEMINE (AMINE), ESTASOL (L.V.ESTER). **Chemical Family:** Phenoxy. **Crop and/or Non-Crop Registrations**: Cereals, turf, pastures, non-crop land, asparagus, field corn, cranberries, raspberries, strawberries, bearing fruit trees including apple, pear, peach, plum, apricot and cherries, water weeds and brush. **Sensitive Weeds:** Most broadleaf weeds, and brush. **Uptake and Translocation:** Readily absorbed through leaves or roots. Translocated primarily in phloem with the sugars but can also move with water in the xylem. Accumulation is primarily in the young, rapidly growing meristematic regions of roots or shoots. **Basis of Selectivity:** Differences in interception, penetration, translocation, metabolism and sensitivity of active sites lead to greater activity on broadleaf weeds compared to grasses. **Application Methods:** Postemergence (broadleaf weeds), stem-foliage or stem-basal (brush). **Residual Activity:** Half-life in soil is usually not longer than 1 or 2 weeks during the growing season due to rapid decomposition by soil micro-organisms. **Unique Characteristics:** All weeds are more easily killed when growing rapidly in moist soil. Unfortunately,some broadleaf crops, garden and ornamental plants are as sensitive to 2,4-D as many weeds and only a trace of the chemical as spray drift, vapour drift or contaminant in soil or water may cause serious damage. Even crops that can be sprayed safely can be sensitive at some stages of growth or at excessive application rates; thus label precautions should be followed carefully. Amines and esters are the most common formulations of 2,4-D. The esters are the most active and can be used at the lower rates and for brush control. Since vapour drift is a potential problem with the ester formulations, only the amines should be used on lawns, or near gardens or susceptible crop areas. Low-volatile esters can be used by agriculturists or licenced applicators in areas where risk of damage to sensitive non-target vegetation is low. Recommendations are on the basis of acid equivalent; commercial products differ in their content of acid equivalent, which must be considered in determining the amount of product to use.

2,4-D/DICAMBA/MECOPROP

Trade Names: KILLEX, KILLEX SUMMER FORMULA, KILLEX 500, KILMOR, PAR III, PREMIUM 3 WAY, TRICEP. **Chemical Family:** Phenoxy/benzoic acid/phenoxy. **Crop and/or Non-Crop Registrations:** KILMOR for spring wheat, winter wheat, barley, corn, oats, non-crop land; KILLEX, TRICEP and PREMIUM 3-WAY TURF HERBICIDE (turf only) and PAR III for turf. **Sensitive Weeds:** At field-crop rates: wild buckwheat, lady's-thumb, green smartweed, Russian thistle, sow-thistle, hedge bindweed, corn spurry, knotweed, volunteer cultivated buckwheat, common ragweed, cocklebur, stinkweed, mustards, prostrate pigweed, redroot pigweed and lamb's-quarters. At non-crop-land rates, a wide range of broadleaf weeds including bull thistle, chicory, goat's beard, ragwort, white cockle, poison-ivy, alder and sheep-laurel. **Application Method:** Postemergence when weeds are small and actively growing; see crop recommendations for specific timing. **Unique Characteristics:** This mixture controls a wider spectrum of weeds than any of the herbicides alone.

2,4-DB

Trade Names: COBUTOX, EMBUTOX 625, CALIBER 400, See 2,4-DB. **Chemical Family:** Phenoxy. **Crop and/or Non-Crop Registrations:** Seedling alfalfa, bird's-foot trefoil, clovers (except sweet) direct seeded or underseeded in spring wheat, barley or oats; corn. **Sensitive Weeds:** Many small broadleaf weeds such as stinkweed, ragweed, lamb's-quarters, wild buckwheat and mustards. Top-growth control of Canada thistle, field bindweed and perennial sow-thistle. **Uptake and Translocation:** Absorbed through the foliage and readily translocated to the growing points. **Basis of Selectivity:** Sensitive weeds rapidly convert 2,4-DB into 2,4-D; tolerant species do not make this conversion under normal conditions. **Application Method:** Post-emergence. **Residual Activity:** None. **Unique Characteristics:** Mustards are not usually controlled by 2,4-DB alone if sprayed beyond the 4-leaf stage; a tank mixture with MCPA will improve control of these larger mustards. Injury to alfalfa increases under drought stress, or when alfalfa seedlings have more than 4 leaves.

38-F DRIFT RETARDANT

Type of Adjuvant: Drift-control agent. **Chemical Composition:** Polyacrylamide polymer 32%. **Registered Uses:** For non-crop use with most water-soluble, emulsifiable or wettable-powder formulations of pesticides. **Benefit:** Drift control.

NB: Trade names and common names [illegible] are cross-referenced in Table 1.

Mode of Action: When tank mixed with a pesticide, 38-F reduces drift by materially reducing fines resulting from shear. **Mixing:** Add 38-F at a steady rate into the mixing tank at the point of maximum agitation. In most cases, this is where the liquid level in the tank is at or just below the injection point of the filling water. After the last tank addition has been made, allow the mixing to continue for a few minutes before using. Refer to product label for more information.

ACIFLUORFEN

Trade Name: BLAZER. **Chemical Family:** Diphenyl ether. **Crop and/or Non-Crop Registrations:** Soybeans. **Sensitive Weeds:** Annual broadleaf weeds including: cocklebur, jimsonweed, lady's-thumb, lamb's-quarters, wild mustard, redroot pigweed, common ragweed and eastern black nightshade. Suppression of perennial weeds including: Canada thistle, hedge bindweed, field bindweed and common milkweed. **Uptake and Translocation:** Taken up through the foliage. Not readily translocated. **Basis of Selectivity:** Metabolism by tolerant species. **Application Methods:** Postemergence when weeds are small and actively growing. Apply in 200–400 L/ha of water with a pressure of 275–400 kPa. Soybeans are tolerant after the first trifoliate-leaf stage. Thorough coverage is necessary. The use of flat fan nozzles is recommended. DO NOT add adjuvants to acifluorfen applied at the full rate. BASAGRAN may be tank mixed with acifluorfen for control of additional broadleaf weeds including velvetleaf. When tank mixing BASAGRAN and acifluorfen the addition of 1 L/ha of ASSIST OIL CONCENTRATE is recommended. **Residual Activity:** Essentially none. **Unique Characteristics:** Acifluorfen is not volatile. Significant crop injury can be expected if acifluorfen is applied during hot, humid weather or if the crop is stressed due to previous herbicide injury, flooding, drought or cold conditions prior to the application. Cool weather or drought may delay control. Rainfall within 6 hours after application may reduce effectiveness. Since there is no residual activity, a new flush of weeds may emerge after the first flush has been controlled.

ADJUVANTS

(See 38-F DRIFT RETARDANT, AGRAL 90, AF-SURF, AMMOMIUM SULPHATE, AMIGO, ASSIST OIL CONCENTRATE, CANPLUS 441, CITOWETT PLUS, COMPANION, DEFOAMERS, DRIFT-CONTROL AGENTS, ENHANCE, FIGHTER F, HALT, KORNOIL, KORNOIL CONCENTRATE, LI700, MERGE, MINERAL OIL [NON-HERBICIDAL], MINERAL OIL/ SURFACTANT [NON-HERBICIDAL], NALCO-TROL, SIDEKICK, SURE-MIX, SYLGARD 309, SPRAY ADJUVANT DEFOAMER, XA OIL CONCENTRATE).

AGRAL 90

Type of Adjuvant: Non-ionic surfactant. **Chemical Composition:** Nonylphenoxy polyethyoxyethanol 90%. **Registered Uses:** For use with diquat, paraquat, glyphosate, imazethapyr, rimsulfuron, nicosulfuron/ rimsulfuron and for washing sprayer tanks and equipment. **Benefit:** Improves chemical effectiveness. **Mode of Action:** It is a wetting and spreading agent that improves coverage of spray mixes. **Mixing:** Use 250–1000 mL/1000 L of spray as specified on label. Will mix with all types of water. Add AGRAL 90 to the spray mixture and agitate thoroughly. **Unique Characteristics:** Do not exceed the recommended rates of AGRAL 90 as too much wetting agent can lead to loss of spray due to excessive run-off.

AG-SURF

Type of Adjuvant: Non-ionic surfactant. **Chemical Composition:** Nonylphenoxy polyethyoxyethanol 92%. **Registered Uses:** For use with glyphosate, imazethapyr and fluazifop-p-butyl. **Benefit:** Improves chemical effectiveness. **Mode of Action:** It is a wetting and spreading agent that improves coverage of spray mixtures. **Mixing:** For use with ROUNDUP: when applying the 2.5 L/ha of water, add AG-SURF at 0.5% (0.50 L/100L water) to maintain adequate surfactant concentration. For use with ROUNDUP to control annual grasses and broadleaf weeds for minimum or zero-till: use 350 mL/ha plus ROUNDUP at 1.1 L/ha in 50–100 L/ha of clean water. For use with FUSILADE 250EC: add 100 mL of AG-SURF for each 100 L of spray solution (0.1%). An antifoaming agent may be required to reduce foaming. **Unique Characteristics:** Do not exceed recommended rates of AG-SURF, as too much may reduce the effectiveness of the herbicide due to excessive run-off. Consult product label for full directions.

AMIGO

Type of Adjuvant: Surfactant. **Chemical Composition:** 30% phosphate ester surfactant. **Registered Uses:** For use with clethodim and clethodim tank mixes. **Benefit:** Improves chemical effectiveness under varying environmental conditions. **Mode of Action:** Improves spreading of spray droplets on the leaf surface and increases contact area. Enhances penetration of herbicide through the leaf cuticle layer. **Mixing:** Half-fill spray tank with water and start agitation. Add the correct amount of herbicide, agitate and then add the correct amount of AMIGO with the remaining water. Continue to agitate.

AMITROLE

Trade Name: AMITROL-T, AMITROL 240. **Chemical Family:** Triazole. **Crop and/or Non-Crop Registrations:** Preplant in corn, soybeans and white beans. Post-harvest in corn, soybeans, white beans, grain, peas, alfalfa and clover. In-season weed control in apples. Use in shelterbelts, non-crop areas, marshes and ditches. Spot treatment in pastures. **Sensitive Weeds:** Many annual and perennial broadleaf weeds and grasses including quack grass, dandelions, Canada thistle, sow-thistle, poison-ivy, poison-oak, toadflax, milkweed, hoary cress, leafy spurge, horsetail, cattail, honeysuckle, locust, ash and sumac. **Uptake and Translocation:** Absorbed by

foliage and roots. Translocates well in xylem and phloem. Accumulates in growing regions of plant. **Basis of Selectivity:** Resistant plants metabolize amitrole more rapidly than sensitive plants and may have lower uptake as a result of leaf structure that reduces wetting and penetration. **Application Methods:** Foliar postemergence application to actively growing plants. Good coverage is essential. If weeds are mature, it is advisable to cut them and then spray the regrowth. Do not disturb treated plants for at least 2 weeks after application. Do not make post-harvest application after October 1. For control of quack grass and Canada thistle, apply in spring or fall to actively growing plants 15–20 cm tall: wait 10–14 days and then plough or disk. **Residual Activity:** Approximately 2–4 weeks in moist, warm soil. **Unique Characteristics:** Most crops are sensitive if contacted. Poor results may occur if spray coverage is inadequate, if plants are drought stressed or overmature, or if heavy rains fall within 6 hours after application. Do not graze or plant to grain, peas, alfalfa or clover for 8 months after treatment. Do not graze spot-treated areas in pastures for 6 months following treatment.

AMMONIUM SULPHATE

Type of Adjuvant: Liquid fertilizer or any granular. **Chemical Composition:** 490 grams/litre ammonium sulphate in water or 100% dry. **Registered Uses:** BASF LIQUID AMMONIUM SULPHATE is registered for use with POAST ULTRA on various crops and BASAGRAN in soybeans only. **Benefit:** Improved and more consistant control of weeds under varying environmental conditions with POAST ULTRA (wild oats, volunteer cereals and quack grass) or BASAGRAN (velvetleaf and lamb's-quarters). **Mode of Action:** Improved uptake of herbicide related to spray or droplet characteristics. **Mixing:** Half-fill spray tank with water and agitate continuously, add LIQUID AMMONIUM SULPHATE followed by POAST ULTRA or BASAGRAN, continue to fill spray tank and add ASSIST oil concentrate last. **Unique Characteristics:** Liquid ammonium sulphate is extremely corrosive to metals, therefore, all metal sprayer parts coming into contact with the spray solution should be checked regularly. Metal spray tips will be subject to corrosion, so the sprayer should be calibrated regularly during the season and tips replaced when necessary.

AQUASHADE

Chemical Family: Water-soluble dyes. **Crop and/or Non-Crop Registrations:** Contained golf course, farm and industrial ponds, fountains and aquariums. **Sensitive Weeds:** Filamentous algae and certain aquatic weeds. **Uptake and Translocation:** The dye filters wavelengths of sunlight reducing the light intensity. **Application Methods:** May be added in a concentrated form from the shoreline or diluted form for larger areas. It is recommended to make the application early in the growing season before algae and weed growth develops. Mechanical removal of heavy vegetation is recommended before applying Aquashade if fish are present in the pond. **Residual Activity:** The effect lasts as long as the water keeps its blue color. Additional Aquashade can be applied when the color of the water fades or when the first new algae and weed growth is noticed. **Unique Characteristics:** It has no direct chemical action and will therefore not harm fish.

ASSIST OIL CONCENTRATE

Type of Adjuvant: Mineral oil/surfactant (non-herbicidal). **Chemical Composition:** 83% paraffin base mineral oil plus 17% surfactant blend. **Registered Uses:** ASSIST OIL CONCENTRATE is registered for use with sethoxydim, BASAGRAN, bentazon/atrazine and atrazine. **Benefit:** The use of ASSIST results in improved postemergence activity and a greater degree of consistency under varying environmental conditions. ASSIST will also aid in providing a faster weed kill. **Mode of Action:** Reduces the evaporation of spray droplets on the leaf surface leading to a longer period for penetration. Improves penetration through the leaf cuticle layer. ASSIST also aids in spreading a spray droplet on the leaf surface so that it covers a greater surface area. **Mixing:** Half-fill the spray tank with water and begin agitation. Add the desired amount of herbicide and continue filling. Add ASSIST last. After filling, continue agitation. Agitate thoroughly after any stoppage in spraying. **Unique Characteristics:** May cause increased temporary topical burn to crop plants under hot, humid weather conditions.

ATRAZINE

Trade Names: AATREX, AATREX NINE-O, ATRAZINE 90W, ATRAZINE 80W, ATRAZINE 500, ATRAZINE 480. **Chemical Family:** S-triazine. **Crop and/or Non-Crop Registrations:** Corn (ensilage, field, seed and sweet), lowbush blueberries and triazine-tolerant canola (rapeseed). **Sensitive Weeds:** Will control a wide range of broadleaf weeds such as mustards, purslane, ragweed, smartweed, lady's-thumb, wild buckwheat, lamb's-quarters, pigweed and volunteer clover. Populations of lamb's-quarters, pigweed and ragweed have been found that are resistant to atrazine and are therefore not controlled. **Uptake and Translocation:** Actively absorbed by roots and foliage, although foliar absorption is usually small. It is translocated to the top of the plant and accumulates in the leaf margins and the growing points. **Basis of Selectivity:** Metabolism by tolerant species. Spray timing avoids contact with lowbush blueberries to prevent injury. **Application Methods:** For corn, preplant incorporated, preemergence, or postemergence (with or without oil) usually before the annual weeds are more than 4 cm high; under dry weather conditions a shallow incorporation may enhance activity; oil or oil/surfactant blends will increase the postemergence activity. For lowbush blueberries, preemergence application. For triazine-tolerant canola, postemergence. Dry bulk fertilizer may be impregnated with atrazine and applied preplant incorporated. Atrazine may be tank mixed with several other annual

grass and broadleaf herbicides to increase the spectrum of weed control in corn. **Residual Activity:** Can persist in the soil for varying lengths of time depending on rate, weather and soil conditions (longer under dry, cool weather conditions and in sandy soils). Postemergence treatments tend to persist longer than preemergence treatments. See section "Special Notes for CORN". **Unique Characteristics:** Atrazine may carry over for more than one planting season. One year after application there is usually no hazard to most rotational crops when 1.5 kg ai/ha or less is applied. Cool, dry weather and sandy soils are conditions under which problems may arise. See "Notes on atrazine and simazine soil residues" in "Special Notes for CORN".

ATRAZINE/2,4-D

Trade Name: SHOTGUN. **Chemical Family:** Triazine/phenoxy. **Crop and/or Non-Crop Registrations:** Field corn. **Sensitive Weeds:** Lady's-thumb, lamb's-quarters, wild mustard, redroot pigweed, common ragweed, velvetleaf, wild buckwheat. **Uptake and Translocation:** Both components may be taken by either roots or shoots, but the atrazine will primarily be absorbed by the roots and travel in the transpiration stream, while the 2,4-D will primarily be absorbed by the shoots and move in the phloem. **Basis of Selectivity:** See notes on 2,4-D and atrazine. **Application Method:** Postemergence. **Residual Activity:** Injury may occur if land treated with atrazine/2,4-D is planted to any crop other than corn in the same season. Sensitive crops such as tobacco and sugar beets should not be planted in the year following treatment. When extended periods of dry weather occur during the year of treatment, there can be some injury to succeeding crops such as white beans, onions, peas, tomatoes and turnips. Injury is most likely to occur when the seedling crop is subjected to periods of stress, e.g., during periods of abnormally hot, dry weather. **Unique Characteristics:** See the 2,4-D note for information about spray and vapour drift. See also "Notes on atrazine and simazine soil residues" in "Special notes for CORN".

BENSULIDE

Trade Name: BETASAN, PREFAR. **Chemical Family:** Benzenesulfonamide. **Crop and/or Non-Crop Registrations:** Lawns, turf and cucumbers. **Sensitive Weeds:** Germinating annual grasses such as annual bluegrass, barnyard grass, crab grass and foxtail. Some control of redroot pigweed, lamb's-quarters and shepherd's-purse. **Uptake and Translocation:** Adsorbed on root surfaces and a small amount is absorbed by the roots. Little or none is translocated upward to the leaves. **Basis of Selectivity:** Inhibits root growth and partially inhibits cell division in sensitive seedlings. Sensitive species affected only in seedling stage. Metabolized by established grasses. **Application Methods:** Preemergence in spring or fall for turf (well-established only); a higher rate is required for fall applications to control germinating weeds the following spring; incorporate by lightly irrigating into soil. **Residual Activity:** Season-long weed control. Degraded slowly by soil micro-organisms with a half-life of 4–6 months depending on soil type. Because of soil residues, only cucurbits, cole crops, carrots, lettuce, peppers and tomatoes should be planted the following year. **Unique Characteristics:** Bensulide is inactivated in soils containing high amounts of organic matter (muck soils). Incorporation recommended to avoid photodecomposition. Do not reseed lawn within 1 year of application. Formulations available with fertilizers for homeowner lawn use.

BENTAZON

Trade Names: BASAGRAN FORTE, BASAGRAN. **Chemical Family:** Benzothiadiazine. **Crop and/or Non-Crop Registrations:** BASAGRAN FORTE AND BASAGRAN: Peas, flax, soybeans, dry beans, faba beans, corn. BASAGRAN also registered for peanuts, lima beans, snap beans, highbush blueberry, new plantings of apples, apricots, cherries, peaches, pears and turf. **Sensitive Weeds:** Annual broadleaf weeds including hairy nightshade, lamb's-quarters, redroot pigweed, low cudweed, purslane, common ragweed, wild radish, Russian thistle, hairy galinsoga, corn spurry, bird rape, flower-of-an-hour, buttercups, common groundsel, jimsonweed, giant ragweed, velvetleaf, lady's-thumb, wild mustard, cocklebur, stinkweed, shepherd's-purse and common chickweed. Triazine-tolerant biotypes of lamb's-quarters, redroot pigweed, common ragweed and common groundsel are also controlled. Top growth of Canada thistle and nut sedge are controlled. Field bindweed may be suppressed by two applications applied 10 days apart. **Uptake and Translocation:** Taken up through the foliage. Not translocated. **Basis of Selectivity:** Metabolism by tolerant species. **Application Methods:** Postemergence when weeds are small and actively growing. Apply in 100–400 L water/ha. Crop must be in a tolerant growth stage (see specific recommendations on label). Thorough spray coverage is necessary. Use flat fan nozzles tilted 45° forward. Use ASSIST OIL CONCENTRATE with BASAGRAN. The ASSIST rate should be reduced under hot, humid conditions. CITOWETT PLUS may replace ASSIST on peas. Liquid ammonium sulphate or 28% urea ammonium nitrate may be added to BASAGRAN FORTE or BASAGRAN for improved and more consistent control of velvetleaf and lamb's-quarters in soybeans only. PINNACLE may be tank mixed with BASAGRAN FORTE or BASAGRAN for improved pigweed and lamb's-quarters control in soybeans only. BASAGRAN FORTE does not require additional adjuvants. BASAGRAN FORTE is not registered for aerial application. BASAGRAN is registered for aircraft application for soybeans, dry and snap beans. **Residual Activity:** Essentially none. **Unique Characteristics:** Corn and turf are tolerant at all stages of growth. Bentazon is not volatile. Temporary crop injury can be expected if bentazon is applied during hot, humid weather or if crop is stressed (flooding, drought, cold). Cool weather or drought may delay control. Rainfall within 6–8 hours after application may reduce effectiveness. Since there is no

residual activity, a new flush of weeds may emerge after the first flush has been controlled.

BENTAZON/ATRAZINE

Trade Name: LADDOK. **Chemical Family:** Benzothiadiazine/s-triazine. **Crop and/or Non-Crop Registrations:** Corn (ensilage, field, seed and sweet). **Sensitive Weeds:** Annual broadleaf weeds such as black nightshade, redroot pigweed, lamb's-quarters, low cudweed, purslane, common ragweed, Russian thistle, corn spurry, flower-of-an-hour, lady's-thumb, wild mustard, hairy galinsoga, bird rape, buttercup, common chickweed, common groundsel, jimsonweed, giant ragweed, velvetleaf and cocklebur. Triazine-tolerant biotypes are also controlled. Top growth of Canada thistle and nut sedge are controlled. Field bindweed may be suppressed. **Uptake and Translocation:** Uptake into the plant occurs primarily through the leaves. Bentazon/atrazine has mainly contact action and translocation is minimal. **Basis of Selectivity:** Metabolism by tolerant species. **Application Methods:** Bentazon/atrazine should be applied early postemergence when weeds are small and actively growing. Apply in 200–400 L water/ha. Application should be made before weeds reach the maximum size listed on the label. This generally corresponds to corn in the 1- to 5-leaf stage. Under good growing conditions, the most effective time for spraying will usually be 18–28 days after planting. ASSIST OIL CONCENTRATE should be added to the spray tank for all applications. Thorough spray coverage is important and flat fan nozzles should be used. The use of flooding nozzles is not recommended because of inadequate coverage. **Residual Activity:** Injury may occur to any crop other than corn planted in the same season on land treated with bentazon/atrazine. In the season after application, there is virtually no hazard to most rotational crops when label rates for annual weed control have been used. Overlap or the use of a double application for nut sedge control may result in injury to rotational crops due to carry over of the atrazine component of bentazon/atrazine. **Unique Characteristics:** Corn is tolerant at all stages of growth. Rainfall within 6–8 hours of application may reduce effectiveness of the spray solution. Bentazon/atrazine is not volatile but it should not be applied when crop is under stress from prolonged cold, wet weather, poor fertility or other factors.

BROMACIL

Trade Names: HYVAR X-L. **Chemical Family:** Uracil. **Crop and/or Non-Crop Registrations:** Non-crop land for total vegetation control and as a spot treatment to control brush. **Sensitive Weeds:** Annual and perennial broadleaf weeds and grasses (broadcast application). Several brush species (spot application). **Uptake and Translocation:** Most readily absorbed through the roots. Surfactants can enhance foliar activity. Translocation is upward with the movement of water to leaves where it inhibits photosynthesis. **Basis of Selectivity:** Non-selective at normal rates. **Application Methods:** For herbaceous weeds, broadcast sprayed, preferably just before or during periods of active weed growth. For brush, spot applications with an exact-delivery handgun sprayer either at the base of target brush or on a grid. **Residual Activity:** Half-life was 5–6 months for 4.4 kg/ha bromacil in a silty loam soil. **Unique Characteristics:** Bromacil should not be used where it is likely to leach, wash or move with eroded soil into contact with the roots of desirable trees and shrubs. Do not apply to brush standing in water.

BROMACIL/2,4-D

Trade Name: CALMIX PELLETS. **Chemical Family:** Uracil/phenoxy. **Crop and/or Non-Crop Registrations:** Non-crop land. **Sensitive Weeds:** Annual and perennial broadleaf weeds and grasses. **Basis of Selectivity:** Non-selective. **Application Methods:** Spread dry, by hand application or Calmix spreader. **Unique Characteristics:** Combination of foliar and root uptake on broadleaf weeds providing faster and longer-lasting weed control than either chemical alone. Also see notes on BROMACIL and 2,4-D.

BROMACIL/DIURON

Trade Name: KROVAR. **Chemical Family:** Uracil/substituted urea. **Crop and/or Non-Crop Registrations:** Non-crop land. **Sensitive Weeds:** Most herbaceous weeds. **Basis of Selectivity:** Non-selective. **Application Method:** Broadcast sprayed just before or during the period of active weed growth. **Unique Characteristics:** Normally fewer species of weeds escape or regrow after use of this mixture compared to use of the same amount of either chemical alone. Also see notes on BROMACIL and DIURON.

BROMOXYNIL

Trade Name: PARDNER. **Chemical Family:** Hydroxybenzonitrile. **Crop and/or Non-Crop Registrations:** Spring wheat, barley, oats, corn, fall rye, triticale and many other grasses, garlic **Sensitive Weeds:** Smartweed, nightshade, velvetleaf, pigweed, common ragweed, cocklebur, stinkweed, and wild mustard are killed if the chemical thoroughly contacts these plants before they have more than 4 true leaves: wild buckwheat and lamb's-quarters control to 8 leaf. Most established perennial broadleaf weeds, chickweed and grasses tolerate field applications of this herbicide. **Uptake and Translocation:** Absorbed by plant foliage and moves very little within the plant. **Basis of Selectivity:** Differential spray retention, uptake, translocation and degradation. **Application Method:** Postemergence. **Residual Act-ivity:** Essentially no soil residual activity. **Unique Characteristics:** Crop injury symptoms (leaf scorch) may develop if the plant is under stress within 2 or 3 days before or after spraying; this stress could be caused by high temperatures or high humidity or, in the case of corn, application following a period of cool, wet weather; such injury usually does not affect yields. The formulation includes a wetting agent to improve the spread of droplets on the leaf. Although bromoxynil is not an effective soil-applied herbicide,

broadleaf crops such as turnips, peas and beans should not be seeded for a week after spray application.

BROMOXYNIL/MCPA

Trade Names: BUCTRIL M. **Chemical Family:** Hydroxybenzonitrile/phonoxy. **Crop and/or Non-Crop Registrations:** Spring and winter wheat, barley, oats, flax, fall rye, corn, timothy hay and canary grass. **Unique Characteristics:** Combination of bromoxynil with MCPA provides better control of mustards than bromoxynil alone. Also see notes on BROMOXYNIL and MCPA.

CANPLUS 411

Type of Adjuvant: Mineral oil/surfactant (non-herbicidal). **Chemical Composition:** 83% paraffin-base mineral oil plus 17% surfactant blend. **Registered Uses:** CANPLUS 411 is registered for use with ASSURE II. **Benefit:** The use of CANPLUS 411 results in improved postemergence activity and a greater degree of consistency under varying environmental conditions. **Mode of Action:** Reduces the evaporation of spray droplets from the leaf surface and decreases the surface tension of spray droplets, thus improving the penetration through the cuticle of leaf surfaces. **Mixing:** Add the required amount of water to spray tank with agitator running. Add ASSURE II and when well mixed add 5–10 L of CANPLUS 411 for each 1000 L of spray solution. **Unique Characteristics:** May cause increased temporary phytotoxicity to crop plants under hot humid weather conditions.

CHLORIMURON-ETHYL

TRADE NAME: CLASSIC. **CHEMICAL FAMILY:** Sulfonylurea. **CROP AND/OR NON-Crop Registrations:** Soybeans. **Sensitive Weeds**: Common ragweed, redroot pigweed, and velvetleaf. **Uptake and Translocation:** Following foliar application, chlorimuron is rapidly absorbed through the leaves and translocated in both xylem and phloem. **Basis of Selectivity:** Inhibition of acetolactate synthase (ALS) enzyme in susceptible plants leads to a rapid cessation of cell division and growth. Tolerant species rapidly convert chlorimuron to non-phytotoxic metabolites. **Application Methods:** Postemergence. **Residual Activity:** Chlorimuron will provide some limited residual activity after application.. **Unique Characteristics:** A non-ionic surfactant must be added at 0.2% v/v. 28% Urea ammonium nitrate (U.A.N.) at 2 L/Ha will improve the control of velvetleaf. Typical symptoms of plant death (chlorosis, necrosis) may occur from 1-3 weeks after application, depending on growing conditions. Favourable growing conditions will speed the activity while cool or dry conditions will delay activity.

CHLORIMURON-ETHYL/ THIFENSULFURON-METHYL

Trade Name: RELIANCE STS. **Chemical Family:** Sulfonylurea. **Crop and/or Non Crop Registrations:** STS soybeans. **Sensitive Weeds**: common ragweed, redroot and green pigweed, velvetleaf, and lamb's-quarters. **Uptake And Translocation:** Following foliar application, the herbicide is rapidly absorbed and translocated in both the xylem and phloem to growing points of sensitive weeds. **Basis of Selectivity**: Inhibition of acetolactase synthase (ALS) enzyme in susceptible plants which leads to a rapid cessation of cell division and plant growth. Tolerant species rapidly metabolize the herbicide into non-phytotoxic metabolites. **Application Methods:** postemergence. **Residual Activity:** Some limited residual activity from the chlorimuron-ethyl component of the herbicide.
Unique Characteristics: Must be applied with an approved adjuvant system including 0.2% v/v non-ionic surfactant. Addition of 28% urea ammonium nitrate (U.A.N.) at 2 L/ha will improve weed control. Plant death of target weeds may take from 1-3 weeks for visual symptoms to develop. Symptoms develop more quickly under favourable growing conditions.

CHLORPROPHAM

Trade Names: CIPC EC, CIPC GR, CIPC. **Chemical Family:** Phenylcarbamate. **Crop and/or Non-Crop Registrations:** Carrots, lettuce, onions, spinach, daffodils, gladioli, iris, tulips and ornamental nursery stock. **Sensitive Weeds:** Annual broadleaf and grass weeds including purslane, chickweed, smartweed, carpetweed, false flax, annual bluegrass, crab grass, rye grass, stink grass and dodder. **Uptake and Translocation:** Readily translocated to the leaves following root absorption. Vapours have been demonstrated to be absorbed by seeds and emerged dodder. **Basis of Selectivity:** Rapid degradation in tolerant plants as well as soil adsorption. **Application Methods:** Preemergence and directed postemergence in specified crops. **Residual Activity:** Tightly bound to soil colloids. The rate of dissipation can vary greatly with microbial activity and moisture level. Both high soil temperature and excessive soil moisture increase the rate of dissipation. **Unique Characteristics:** Use the lower rates on sandy or coarse-textured soils and the higher rates on clay or muck soils. Weed control is most effective when soil temperatures are below 16°C. The lower rate should be used when soil temperature is below 16°C. The soil must be moist for effective weed control.

CHLORSULFURON

Trade Name: TELAR. **Chemical Family:** Sulfonyl urea. **Crop and/or Non-Crop Registrations:** Non-crop land. **Sensitive Weeds:** Annual and perennial broadleaf weeds such as wild carrot, Canada thistle, sow-thistle, scentless chamomile, lamb's-quarters, wild mustard, redroot pigweed, stinkweed, cow cockle, chickweed and Russian thistle. **Uptake and Translocation:** Thoroughly systemic after absorption of either foliage or roots. Foliar absorption is rapid. **Basis of Selectivity:** A disruption of amino acid metabolism leads to an inhibition of cell division in sensitive plants. Faster rates of metabolic detoxification have been observed in tolerant species. **Application Methods:** Preemergence or early

postemergence. **Residual Activity:** Half-life is 4–6 weeks under growing season conditions. Degradation is faster with higher soil temperatures and/or lower soil pH. **Unique Characteristics:** Although degradation is moderately rapid, extremely low residues can be highly toxic to some broadleaf weeds, such as wild carrot, for up to 2 years after application. Use of this product requires a surfactant.

CITOWETT PLUS

Type of Adjuvant: Non-ionic spreader sticker surfactant. **Chemical Composition:** Octyl phenoxy poly polyethoxy ethanol 50%. **Registered Uses:** Corn/atrazine; sugar beets and red beets/pyrazon; peas/bentazon. **Benefit:** Improves postemergence control of weeds that have reached their upper limit in size for susceptibility. **Mode of Action:** Causes the spray mix to form a continuous film on leaf surfaces; also makes herbicide more rainfast. **Mixing:** Half-fill tank with water; add herbicide with continuous agitation; complete filling of tank with water; add CITOWETT with continuous agitation. **Unique Characteristics:** Higher rates are required with hard water.

CLETHODIM

Trade Name: SELECT. **Chemical Family:** Cyclohexanedione. **Crop and/or Non-Crop Registrations:** Canola, flax, soybeans, sunflowers, dry onions, and potatoes . **Sensitive Weeds:** Annual grasses (wild oats, green and yellow foxtail, volunteer cereals, volunteer corn and barnyard grass). **Uptake and Translocation:** Uptake through the foliage and translocated through both the phloem and xylem throughout the plant accumulating in the meristemic regions both above and below the ground. **Basis of Selectivity:** Tolerant plants rapidly metabolize clethodim to several conjugated metabolites. **Application Method:** Postemergent to actively growing grasses in the 2- to 6 true-leaf stage. **Residual Activity:** Rapid degradation in both soil and water with no soil activity. **Unique Characteristics:** Highly active on all annual grasses and volunteer cereals at one low dose rate of 0.19 L/ha in a tank mix with the adjuvant CC-16255.

CLOPYRALID

Trade Names: LONTREL, LONTREL 360, TRANSLINE. **Chemical Family:** Pyridine. **Crop and/or Non-Crop Registrations:** Strawberries, highbush blueberries, new and bearing apples, cranberries, sugar beets, rutabagas, cole crops (cabbage, cauliflower, broccoli, asian cole crops), control of broadleaf weeds in rights-of-way (hydro, railroad, communication lines, pipelines) and associated stations, industrial manufacturing sites, storage sites and roadsides, airports, military bases and low maintenance, rough-turf areas, rangeland, grass pasture and balsam fir Christmas tree stands or plantations. **Sensitive Weeds:** Will control or suppress certain annual and perennial weeds including Canada thistle, goldenrod, ox-eye daisy, tufted vetch, sheep sorrel, dandelion and wild buckwheat, scentless chamomile, groundsel, ragweed, coltsfoot and spotted knapweed. **Uptake and Translocation:** Rapidly absorbed by foliage and translocated readily throughout the plant via both xylem and phloem systems. Clopyralid is distributed throughout the plant to the meristem. **Basis of Selectivity:** Effects on nucleic acid metabolism and growth are not observed in grasses and other tolerant species. **Application Methods:** Postemergence as a broadcast or selective foliar. **Residual Activity:** Half-life in soil is less than 30 days under conditions that are favourable for microbial degradation. Little to no residual activity. **Unique Characteristics:** Clopyralid has little to no activity on woody vegetation, except woody species of the legume family.

COMPANION

Type of Adjuvant: Non-ionic surfactant. **Chemical Composition:** Octylphenoxy-polyethoxy-(9)-ethanol 70%. **Registered Uses:** For use with chlorsulfuron. **Benefit:** Improves chemical effectiveness. **Mode of Action:** It is a wetting and spreading agent that improves coverage of spray mixes. **Mixing:** For use with glyphosate for the control of annual grasses and broadleaf weeds, add 450 mL of COMPANION in 50–100 L of water/ha. With chlorsulfuron, add 100 mL of COMPANION to 100 L of water for the control of broadleaf weeds. Use constant agitation. **Unique Characteristics:** Do not exceed the recommended rates of COMPANION as too much may reduce the effectiveness of the herbicide due to excessive run-off.

COPPER CITRATE AND GLUCONATE

Trade Name: ALGIMYCIN PLL-C. **Chemical Family:** Chelates of copper gluconate and copper citrate. **Crop and/or Non-Crop Registrations:** Algae control in wholly enclosed farm, fish and fire ponds having no outflow beyond the property limits of the user. **Sensitive Weeds:** Most algae including Spirogyra, Ulothrix, Cladophora, Chara and Nitella. **Uptake and Translocation:** No information available. **Basis of Selectivity:** Non-selective. **Application Methods:** Available as a tablet or a liquid formulation. Apply early in the season where algae is well established and growing vigourously. Apply early in the day as sunlight enhances the effectiveness of the treatment. To ensure even distribution, apply tablet formulation with a hand scoop. Apply liquid directly onto floating mats of algae or inject below surface for algae growing on the bottom of the pond, with a small hand sprayer or backpack sprayer. To avoid oxygen depletion, treat 1/3–1/2 of the water area in a single operation and wait at least 10–14 days between treatments. **Residual Activity:** One application of the tablet formulation of ALGIMYCIN should provide control over the entire year. When using liquid ALGIMYCIN, a second treatment or spot treatment later in the season may be required. **Unique Characteristics:** The tablet formulation is more effective than the liquid formulation for the control of Chara and Nitella. Not for use in public waters or waters that drain into public

waters. Do not apply in deep waters. May be toxic to trout and other species of fish. Do not apply directly to crop plants, seedling grasses or non-established ornamental plants, as injury may result. Not for use in potable water systems.

COPPER ETHANOLAMINE

Trade Name: CUTRINE-PLUS. **Chemical Family:** Mixture of chelates of copper ethanolamines. **Crop and/or Non-Crop Registrations:** Algae control in wholly enclosed farm, fish and fire ponds and fish hatcheries having no outflow beyond the property limits of the user. **Sensitive Weeds:** Microcystis, Oscillatoria, Anabaena, Aphanizomenon, Spirogyra, Cladophora, Vaucheria, Ulothrix, Chara and Nitella. **Uptake and Translocation:** No information available. **Basis of Selectivity:** Non-selective. **Application Methods:** Available as a granular or liquid formulation. Apply early in the day as ample sunlight is required for maximum control. To ensure even distribution of the granular formulation, employ a scoop or dry fertilizer spreader. Use a hand or power sprayer for best distribution of the liquid formulation. To avoid oxygen depletion, treat only 1/3–1/2 of the pond at a time. Allow 1–2 weeks between treatments. **Residual Activity:** One application of granular CUTRINE-PLUS should provide control over the entire season. When using liquid CUTRINE-PLUS, a second treatment later in the season may be required. **Unique Characteristics:** Not for use in potable waters. Not for use in public waters or waters that drain into public waters. Extremely toxic to fish in soft waters; toxic in hard waters if the maximum recommended concentration is exceeded; if fish are present but water hardness is not known, do not use CUTRINE-PLUS. Treated areas may be used for swimming or fishing immediately after treatment. Water from treated pools may be used to irrigate turf, fairways, putting greens and ornamental plants.

CORNOIL

(See KORNOIL)

CORNOIL CONCENTRATE

(See KORNOIL CONCENTRATE)

CYANAZINE

Trade Names: BLADEX LIQUID, BLADEX 90DF. **Chemical Family:** S-triazine. **Crop and/or Non-Crop Registrations:** Corn (ensilage, field and sweet), triazine-tolerant canola (rapeseed). **Sensitive Weeds:** Annual nightshades, purslane, lady's-thumb, lamb's-quarters, prostrate knotweed, shepherd's-purse, wild buckwheat, wild mustard, wormseed mustard, velvetleaf, pigweed, crab grass, green foxtail, yellow foxtail, witch grass, fall panicum and barnyard grass. **Uptake and Translocation:** Readily absorbed by roots and foliage. When absorbed by roots it is translocated to the leaves. **Basis of Selectivity:** Metabolism by tolerant crops. **Application Methods:** Preplant incorporated in corn but only in mixtures with other corn herbicides; incorporation equipment should be set to work no deeper than 10 cm. Preemergence in corn; moisture is required for activation. Early postemergence in corn up to the 3-leaf stage (wettable granule). Early postemergence in triazine-tolerant canola (liquid formulation). **Residual Activity:** Cyanazine has a relatively short residual life in the soil; from normal spring applications there is no carryover of the herbicide to the next growing season. **Unique Characteristics:** Cyanazine is a short-lived triazine herbicide with flexible application time. Preemergence applications do not adequately control barnyard grass, fall panicum or pigweed under conditions that delay germination, such as low temperature or dry soil surface. Emerged velvetleaf will be controlled by the early postemergence application but subsequent germinating velvetleaf will not be controlled. Cynazine is not recommended alone for use on heavy clay soil. Do not use on peat, muck soils, sandy soils or soils with less than 1% organic matter. Do not use the liquid formulation postemergence in corn. Do not add oil or surfactants other than as specified on the label. Cyanazine may be used in tank mixes and has been formulated with various other herbicides. See label for specifications.

CYCLOATE

Trade Name: RO-NEET. **Chemical Family:** Thiocarbamate. **Crop and/or Non-Crop Registrations:** Red beets, spinach. **Sensitive Weeds:** Crab grasses, barnyard grass, foxtails, yellow nut sedge and some annual broadleaf weeds. **Uptake and Translocation:** Uptake by seed, roots and hypocotyl with upward translocation to the growing tip. **Basis of Selectivity:** Species differentiation due to enzymatic detoxification and seed food reserves permitting seedling to outgrow effect of chemical. **Application Methods:** Preplant incorporated. To prevent chemical loss, incorporate immediately into the soil by setting the incorporation equipment (i.e., tandem disks, field cultivator with sweep teeth, or vibrating shank S-tine cultivator) to work the soil approximately 10 cm deep followed by a levelling device. Irrigation (approximately 0.6 cm) can also be used to incorporate. When application and incorporation are done in separate operations, application should be to a dry soil surface. **Residual Activity:** Season-long weed control with no soil residues the following year to prevent crop rotation. **Unique Characteristics:** Does not need rainfall to activate and will not leach significantly under heavy rainfall. Under unfavourable germination conditions, leaf crinkling or leaf sealing may be observed, but usually without adverse effects on crop yield.

DAZOMET

Trade Name: BASAMID. **Chemical Family:** Dithiocarbamate. **Crop and/or Non-Crop Registrations:** Field and greenhouse vegetable seedbeds for eggplant, lettuce, pepper and tomato; fall treatment only of tobacco greenhouse seedbeds; field and greenhouse seed and planting beds for annual flowers; turf seedbeds. **Sensitive Weeds:** Most germinating weed seeds. **Uptake and**

Translocation: Breaks down on contact with soil moisture and releases toxic gases that control germinating weed seeds. **Basis of Selectivity:** Non-selective. Chemical must be completely dissipated from the seedbed before planting or injury may occur. Breaks down on contact with soil moisture and releases toxic gases that control germinating weed seeds. **Application Methods:** Apply granular product to a well- worked seedbed and incorporate evenly. Seal soil immediately after incorporation by rolling and flooding or by covering with heavy polyethylene plastic and sealing edges. After a waiting period of 10–40 days, depending on soil temperature, aerate the soil. Conduct a safety germination test before using treated soil. Do not use when soil temperature is below 6°C. **Residual Activity:** Depends on the rate applied, soil moisture and soil temperature. The gases are toxic to all growing plants and a safety germination test must be carried out to determine that the soil is safe for planting. **Unique Characteristics:** Also controls unencysted nematodes and soil fungi.

DEFOAMERS

(See FIGHTER F, HALT, SPRAY ADJUVANT DEFOAMER)

DESMEDIPHAM

Trade Name: BETANEX. **Chemical Family:** Phenylcarbamate/Phenylcarbamate. **Crop and/or Non-Crop Registrations:** Sugar beets. **Sensitive Weeds:** Redroot pigweed, lamb's-quarters and wild mustard. Other weeds like ragweed species, wild buckwheat, nightshade species, kochia, goosefoot and stinkweed will be controlled when application of desmedipham is made following treatment with another preplant or preemergence herbicide. **Uptake and Translocation:** Desmedipham is readily absorbed by foliage where it inhibits photosynthesis in the chloroplasts of leaf cells. **Basis of Selectivity:** Rapid metabolism in tolerant species. **Application Methods:** Postemergence beginning at the 2 true-leaf stage of sugar beets. Up to the 2- or 4-leaf stage of weeds depending upon species. Best control is exhibited on very small, actively growing weeds. **Residual Activity:** Soil half-life of desmedipham is less than 1 month. **Unique Characteristics:** Desmedipham may cause temporary growth retardation and/or chlorosis or tip-burn to sugar beets when applied to stressed plants. Normal growth is resumed in 10 days after application.

DESMEDIPHAM/PHENMEDIPHAM

Trade Name: BETAMIX. **Chemical Family:** Phenylcarbamate. **Crop and/or Non-Crop Registrations:** Sugar beets. **Sensitive Weeds:** Pigweed species, lamb's-quarters, wild mustard, wild buckwheat, green and yellow foxtail. Other weeds like ragweed species, nightshade species, kochia, goosefoot and stinkweed will be controlled when application of desmedipham/phenmedipham is made following treatment with another preplant or preemergence herbicide. **Uptake and Translocation:** Desmedipham/ phenmedipham is readily absorbed by foliage where it inhibits photosynthesis in the chloroplasts of leaf cells. **Basis of Selectivity:** Rapid metabolism in tolerant species. **Application Methods:** Postemergence beginning at the 2 true-leaf stage of sugar beets. Up to the 2- or 4-leaf stage of weeds depending upon species. Best control is exhibited on very small, actively growing weeds. **Residual Activity:** Soil half-life of desmedipham is less than 1 month and of phenmedipham is 25–30 days. **Unique Characteristics:** Desmedipham/phenmedipham may cause temporary growth retardation and/or chlorosis or tip-burn to sugar beets when applied to stressed plants. Normal growth is resumed in 10 days after application.

DICAMBA

Trade Names: BANVEL II, , DYCLEER. **Chemical Family:** Benzoic acid. **Crop and/or Non-Crop Registrations:** Field corn, spring and winter wheat, spring barley, spring rye, oats, summer fallow and stubble, pastures, red fescue, lowbush blueberries and turf; non-crop areas such as roadsides, utility rights-of-way and railways. **Sensitive Weeds:** Annual, perennial and biennial broadleaf weeds and numerous brush species including conifers. Particularly effective against velvetleaf, Canada thistle, field bindweed and various triazine-resistant broadleaf weeds. Control is best when weeds are small and actively growing. **Uptake and Translocation:** Readily absorbed by roots, stems or leaves and then translocated to other plant parts. **Basis of Selectivity:** Metabolism by tolerant species. **Application Methods:** Preemergence or postemergence in field corn. For all other crops and non-crop uses, postemergence applications are recommended. **Residual Activity:** Half-life in soil is approximately 30 days. Residue carryover into the next season is not a problem when applied at rates recommended for crop situations. **Unique Characteristics:** Dicamba is often mixed with grass herbicides or with phenoxy herbicides to provide a broader spectrum of weed control. Spray drift is toxic to sensitive plants in the same manner as 2,4-D, thus similar precautions should be followed. Cold weather conditions and/or subsequent high rainfall after dicamba application may lead to temporary corn injury particularly on early-season hybrids in Eastern Ontario. There is also a possibility of dicamba vapour drift from treated plant foliage during high temperatures (in excess of 25°C). At higher rates, dicamba can be toxic to trees and shrubs having roots under the treated areas. See sections on Herbicide Drift and Reduction of Herbicide Drift.

DICAMBA/ATRAZINE

Trade Name: MARKSMAN. **Chemical Family:** Benzoic acid/s-triazine. **Crop and/or Non-Crop Registrations:** Field corn. **Sensitive Weeds:** Annual and biennial broadleaf weeds including the triazine-resistant biotypes. **Application Methods:** Postemergence until the standing height of the corn is 13 cm (5-leaf stage). **Unique Characteristics:** This mixture provides excellent control of triazine-resistant broadleaf weeds, maintains a low level of triazine for

short-term residue and gives improved control of velvetleaf. Also see notes on dicamba and atrazine.

DICAMBA/MCPA

Trade Name: DYVEL. **Chemical Family:** Benzoic acid/phenoxy. **Crop and/or Non-Crop Registrations:** Barley, spring wheat, winter wheat and oats. **Unique Characteristics:** Provides better control of mustards and hemp-nettle than dicamba alone. Also see notes on dicamba and mcpa.

DICAMBA/MCPA/MECOPROP

Trade Name: TARGET. **Chemical Family:** Benzoic acid/phenoxy/phenoxy. **Crop and/or Non-Crop Registrations:** Spring wheat, barley, oats not underseeded to legumes, stubble fields and summer fallow. **Sensitive Weeds:** At field-crop rates: wild buckwheat, cow cockle, lady's-thumb, green smartweed, mustards, hemp-nettle, Russian thistle, corn spurry, flixweed, annual sow-thistle, shepherd's-purse, common ragweed, pigweeds, chickweed, lamb's-quarters, knotweed, volunteer rapeseed and sunflowers. **Application Methods:** Postemergence when weed seedlings are in the 2- to 3-leaf stage, spring wheat and oats are in the 4- to 5-leaf stage and barley is in the 2- to 3-leaf stage. Use water carrier and apply at 100 L total spray mix/ha. **Unique Characteristics:** This mixture controls a wider spectrum of weeds than any of the herbicide components used alone. Under certain conditions, this mixture may cause shortening of the straw of cereals but yield will not be affected. See also dicamba, mecoprop and mcpa.

DICHLOBENIL

Trade Name: CASORON. **Chemical Family:** Benzonitrile. **Crop and/or Non-Crop Registrations:** Cranberries, fruit trees, grapes, highbush blueberries, raspberries, container nursery stock, woody nursery stock, shelterbelts and non-crop areas. **Sensitive Weeds:** Most weeds are susceptible to or suppressed by, dichlobenil including perennials, vetch and horsetail. **Uptake and Translocation:** Absorbed by the roots and rapidly translocated upward in the plant. **Basis of Selectivity:** Selectivity is based on physical separation between the dichlobenil vapour layer in the top 5 cm of soil and the established crop roots below this level. **Application Methods:** Applied preemergence to the weeds, preferably in either fall or early spring. **Residual Activity:** May persist and provide weed control for 2–6 months; higher rates and applications following use in previous year(s) may result in soil residues persisting for longer than 1 year. **Unique Characteristics:** Although applied as a granular herbicide it kills by means of a vapour phase in the top soil profile. Weed roots take up the herbicide as they enter this zone. Do not apply dichlobenil during periods of high soil temperature, since loss of control will result due to volatilization of the herbicide.

DICHLORPROP/2,4-D

Trade Names: DICHLORPROP D, DIPHENOPROP BK 700, ESTAPROP, SEE DIPHENOPROP, TURBOPROP, WEEDONE CB. **Chemical Family:** Phenoxy/phenoxy. **Crop and/or Non-Crop Registrations:** Spring and fall wheat and barley; turf; perennial weed and brush control on non-crop land. **Unique Characteristics:** Most properties of dichlorprop are very similar to those of 2,4-D. Chickweed, wild buckwheat, smartweed and some woody species are more sensitive to dichlorprop/2,4-D than to 2,4-D alone. Do not use on oats. See also 2,4-D.

DICLOFOP-METHYL

Trade Name: HOE-GRASS 284. **Chemical Family:** Aryloxyphenoxypropionate. **Crop and/or Non-Crop Registrations:** Potatoes, white beans, kidney beans, carrots, onions, snap beans, soybeans, rapeseed (canola), lima beans, wheat barley, mustard, alfalfa, clover, peas. **Sensitive Weeds:** Barnyard grass, foxtails, witch grass, fall panicum, wild oats, volunteer corn. **Uptake and Translocation:** Primarily through the leaves. Does not translocate significantly. **Basis of Selectivity:** Differential metabolism by tolerant vs. sensitive species. **Application Methods:** Postemergence when grass weeds are in the 1- to 4-leaf stage. **Residual Activity:** Essentially none. **Unique Characteristics:** Tank mixtures with broadleaf herbicides will result in reduced weed control. A time interval of 4 days before or after an application of diclofop-methyl is required.

DIFENZOQUAT

Trade Name: AVENGE 200C. **Chemical Family:** Quaternary ammonium. **Crop and/or Non-Crop Registrations:** Barley, spring wheat (Neepawa, Glenlea, Selkirk, Chester, Canuck, Benito, Columbus, Fielder, Leader, Katepwa, Conway, Kenyon, Lancer, Oslo, Genesis, Pasqua, Bluesky, Wildcat, Biggar and HY320 varieties only); triticale (Welsh and Carmen); winter wheat (Norstar and Sundance); fall rye (Cougar, Puma, Frontier, Rymin, Kodiak): canary seed; forages underseeded to barley or wheat. **Sensitive Weeds:** Wild oats (tame oats also killed). **Uptake and Translocation:** Readily absorbed by foliage. Not translocated. **Basis of Selectivity:** Not established. **Application Methods:** Postemergence to actively growing wild oats at the 3- to 5-leaf stage. Do not apply to plants that are wet with dew or rain, or if rain is expected within 6 hours. **Residual Activity:** Essentially none. **Unique Characteristics:** The lower leaves of barley can be injured if cool weather conditions are present at the time of spraying or up to 2 days after. Frost or temperatures within 2 degrees of frost will accentuate this injury. This injury is usually temporary and does not reduce barley yield. See label for registered tank mixes.

DIFLUFENZOPYR/DICAMBA

Trade Name: DISTINCT. **Chemical Family:** Semicarbazone/Benzoic acid. **Crop and/or Non-Crop Registrations:** Field Corn (silage and grain). **Sensitive Weeds:** Redroot pigweed, common ragweed, lamb's-quarters, wild buckwheat, lady's-thumb, and velvetleaf. Control is best when weeds are

actively growing. **Uptake and Translocation:** Readily absorbed by roots, stems or leaves and then translocated to other plant parts. **Basis of Selectivity:** Metabolism by tolerant species. **Application Methods:** Early postemergence to 6 leaf corn recommended. **Residual Activity:** Half-life in soil is approximately 30 days. Residue carryover into the next season is not a problem when applied at registered rates. **Unique Characteristics:** This product has a wider application window, a lower use rate and has better activity on perennial weeds than dicamba alone. Spray drift is toxic to sensitive plants in the same manner as 2,4-D, thus similar precautions should be followed. The auxin transport inhibitor, diflufenzopyr, will also be active with other growth hormone herbicides such as 2,4-D and clopyralid and may cause crop injury if tankmixed. Do not use additives such as oils, ionic surfactants, wetting agents, sticking agents etc. Do not apply when there is a risk of severe drop in night temperature. Do not spray when temperatures are expected to exceed 27°C. Do not spray in high humidity or fog. Do not apply preemergence on sandy or sandy loam soils. Do not till or cultivate treated area for at least 7 days following application. The addition of a non-ionic surfactant at 0.25% v/v plus liquid nitrogen fertilizer 28-0-0 at 1.25% is recommended under postemergence applications.

DIMETHENAMID

Trade Name: FRONTIER. **Chemical Family:** Chloroacetamide. **Crop and/or Non-Crop Registrations:** Corn, dry beans and soybeans. **Sensitive Weeds:** Green and yellow foxtail, barnyard grass, fall panicum, witch grass, large and smooth crab grass, redroot pigweed and eastern black nightshade. **Uptake and Translocation:** Absorbed through shoots and roots of germinating grass and broadleaf weeds but primarily via plant coleoptile. **Basis of Selectivity:** Not established. **Application Method:** 1) preplant incorporated — incorporate with vibrating shank cultivator, harrow or other implement capable of giving uniform shallow incorporation into the top 5 cm of the soil within 7 days of planting; 2) Preemergence — rainfall is required within 10 days of appliation to achieve sufficient herbicide activation; 3) Early postemergence (corn only) — apply at the spike to 2-leaf stage of corn and up to the 2-leaf stage of annual grass weeds. **Residual Activity:** Provides season-long weed control. Length of residual activity depends upon soil and moisture factors, application rate and timing. Heavy rainfall following an incorporated treatment may reduce weed control. **Unique Characteristics:** No recropping restrictions in the fall or spring application in corn or soybeans. Application flexibility; there are many tank mix and sequential treatment options for broad-spectrum weed control in corn and soybeans in all tillage systems (zero tillage to conventional tillage). Mixes well with bulk liquid and dry fertilizers.

DIQUAT

Trade Name: REGLONE. **Chemical Family:** Bipyridylium. **Crop and/or Non-Crop Registrations:** Desiccation of canola (rapeseed), flax, dry beans, dry peas, mustard, sunflowers, soybeans, adzuki beans, legume seed crops. Vine killing of potatoes. Control of corn spurry in oats. Stale seedbed and inter-row weeding. **Sensitive Weeds:** Any foliage contacted by diquat will be killed. **Uptake and Translocation:** Rapidly absorbed by foliage. Limited translocation. **Basis of Selectivity:** None. **Application Methods:** Postemergence. **Residual Activity:** Essentially none due to adsorption of chemical to soil particles. **Unique Characteristics:** Must be used with clean (non-turbid) water as the soil particles in muddy water drastically reduce the effectiveness of diquat. Apply in weather conditions that will not promote drift. For aerial application suggested conditions for good application are moderate temperatures (less than 25°C), humidity (greater than 40%) and wind (3.6–10 kph). Do not apply in dead calm conditions or when temperature inversion is likely (e.g., morning or evening when warm air is rising from crop). To avoid spray drift, use flat fan or hollow cone nozzles and a pressure of 140–210 kPa. For aerial application point the nozzles back 130°–180°. For further information on aerial application refer to the product label.

DIQUAT (AQUATIC)

Trade Name: REGLONE A. **Chemical Family:** Bipyridylium. **Crop and/or Non-Crop Registrations:** Aquatic weed control in still or flowing water in ponds, ditches, lakes and canals. **Sensitive Weeds:** Coontail, Canada water weed, pondweeds, milfoil and duckweed. **Uptake and Translocation:** Contact desiccant with limited translocation. **Basis of Selectivity:** None. **Application Methods:** Postemergence. Apply when weeds are visible and are actively growing. It can be applied: with a boat bailer device that injects the chemical below the water surface; sprayed over the water surface; or poured directly from a container onto the surface. **Residual Activity:** Quickly inactivated by adsorption to soil particles. **Unique Characteristics:** Must be used with and applied on non-turbid water, as the soil particles in muddy water drastically reduce the effectiveness of the material. Apply at dusk. Do not use treated water for swimming or consumption by humans or animals for at least 24 hours. Do not use water for irrigation for 5 days after treatment. To avoid fish kills caused by oxygen depletion, treat only 1/4–1/3 of the area at a time. Avoid application or drift onto crops, lawns, grazing areas, ornamental plants and other desirable plants.

DITHIOPYR

Trade Name: DIMENSION. **Chemical Family:** Pyridine. **Crop and/or Non-Crop Registrations:** Turf. **Sensitive Weeds:** Crab grass. **Uptake and Translocation:** Absorbed through the shoots and roots. Translocation is limited. **Basis of Selectivity:** Differential uptake, translocation and metabolism in sensitive seedling weeds vs. established plants. **Application Methods:** Preemergence or early postemergence up to the 3-leaf stage of crab grass.

NB: Trade names and common names of [illegible] are cross-referenced in Table 1.

Residual Activity: Effective weed control may be maintained for 3 months. **Unique Characteristics:** Preemergence and early postemergence activity allows control of emerged plants and follow-up residual control of later germinating crab grass plants.

DIURON

Trade Name: KARMEX. **Chemical Family:** Substituted urea. **Crop and/or Non-Crop Registrations:** Grapes, asparagus, gladioli, industrial sites, right-of-ways. **Sensitive Weeds:** Annual and perennial grasses, pigweed, ragweed, wild carrot and dandelion. Perennial weed control at higher rates in non-crop areas. **Uptake and Translocation:** Most readily absorbed by roots, less so by foliage. Translocated upward in the xylem. **Basis of Selectivity:** Used only in deep-rooted crops that are well established. **Application Methods:** Applied to crops as a preemergence or directed early postemergence spray, preferably before weed growth becomes dense. Better control of emerged weeds is obtained by the addition of a suitable surfactant. In non-crop areas, diuron may be sprayed anytime except when ground is frozen. **Residual Activity:** At lower rates used in crops, residues last about a year and thus applications may be repeated annually. At higher non-crop rates, persistence may be more than 1 year. **Unique Characteristics:** Should not be used where it is likely to leach or wash into contact with the roots of desirable trees or shrubs.

DRIFT-CONTROL AGENTS

(See 38-F DRIFT RETARDANT, NALCO-TROL.)

ENDOTHALL

Trade name: HERBICIDE 273. **Chemical Family:** dicarboxylic acid **Crop And/Or Non-Crop Registrations:** Sugar beets. **Sensitive Weeds:** Lady's-thumb, wild buckwheat, redroot pigweed, green foxtail and barnyard grass. **Uptake And Registration:** absorbed through the roots and shoots of actively growing weeds. **Basis Of Selectvity:** Not established. **Application Method**: 1) preemergence broadcast spray onto seedbed during or just after planting. May also mix with sand and apply as a banded treatment. 2) post emergence- apply as a broadcast or banded treatment only after the weeds have emerged. For best results, the sugar beets should be in the 4 to 6 leaf stage and the average temperature should be above 15 ° C. Do not apply later than 40 days after emergence. **Residual Activity:** Very short, up to 7 days. **Unique Characteristics:** High moisture after application is essential for the best weed control. Works very slowly. Only tankmix with betamix or betanex to expand weed control to include smartweed, knotweed, lamb's-quarters, ragweed, shepherd's-purse and nightshade.

ENHANCE

Type of Adjuvant: Cationic surfactant with an additional non-ionic component. **Chemical Composition:** Mixture of tallow fatty acid amine ethoxylate and nonylphenoxy polyethoxy ethanol. **Registered Uses:** Season-long control of quack grass at low rate of glyphosate. For use with post-emergent applications of imazethapyr in soybeans. **Benefit:** Improves consistency of performance, particularly at high water volumes and under stressful growing conditions. **Mode of Action:** Improves leaf wetting and adhesion; increases overall penetration, resulting in enhanced uptake of glyphosate. **Mixing:** Half-fill the sprayer tank with clean water then add the required amount of glyphosate. While agitating, add the required amount of ENHANCE (0.5 L/ha in 100–200 L/ha of water) and complete filling the sprayer tank with water.

EPTC

Trade Name: EPTAM. **Chemical Family:** Thiocarbamate. **Crop and/or Non-Crop Registrations:** Alfalfa, bird's-foot trefoil, snap or dry beans (including kidney), flax, potatoes, sunflowers and annual flowers. **Sensitive Weeds:** Annual grasses such as crab grass, barnyard grass, fall panicum, wild oats, green foxtail and yellow foxtail; yellow nut sedge; some annual broadleaf weeds such as corn spurry, lamb's-quarters, nightshade, pigweed and chickweed if conditions are favourable for germination and growth. **Uptake and Translocation:** Uptake by underground plant parts (roots, hypocotyl and seed). Upward translocation to the growing tip. **Basis of Selectivity:** Metabolized by tolerant species at the seed germination stage through enzymatic breakdown of the chemical. Seed food reserves also permit seedling to outgrow chemical effect. **Application Methods:** Preplant incorporated or postplant incorporated. May be applied using water or liquid fertilizers as the carrier. Dry fertilizers may also be used as a carrier when impregnated by licenced fertilizer dealers. To prevent chemical loss and reduced weed control, EPTC should be uniformly incorporated in the soil by setting the incorporation equipment (i.e., tandem disks, field cultivator with sweep teeth, or vibrating shank S-tine cultivator) to work the soil approximately 10 cm deep, followed by a levelling device. Irrigation (approximately 0.6 cm) can also be used to incorporate. When application and incorporation are done in separate operations, application should be a dry soil surface. **Residual Activity:** Applied in the spring preplant, EPTC provides season-long weed control with no soil residues the following year to prevent crop rotation. **Unique Characteristics:** EPTC does not need rainfall to activate and will not leach significantly under heavy rainfall. Under unfavourable germination conditions, leaf crinkling or leaf sealing may be observed on certain crops but usually without adverse effects on yield. May be tank mixed with metribuzin for additional broadleaf weed control in potatoes. May be tank mixed with ethalfluralin or trifluralin for additional broadleaf weed control in beans (white, snap and kidney). See label for other tank mix combinations and information on less conventional methods of application.

EPTC/R25788 (EPTC+)

Trade Name: ERADICANE. **Chemical Family:** Thiocarbamate. **Crop and/or Non-Crop Registrations:** Corn (ensilage, field and sweet). **Sensitive Weeds:** Annual grasses such as wild oats, crab grass, barnyard grass, foxtails, fall panicum; suppression of wild proso millet; yellow nut sedge, horsetail and some annual broadleaf weeds when conditions are favourable for germination and growth. **Uptake and Translocation:** Uptake by underground plant parts (roots, hypocotyl and seed) then upward translocation to the growing tip. **Basis of Selectivity:** Metabolized by tolerant species at the seed germination stage through breakdown of the chemical. R25788 enhances the enzymatic breakdown of the chemical in tolerant species. Also, seed food reserves permit corn seedlings to outgrow chemical effect. **Application Methods:** EPTC/R25788 may be applied using water or liquid fertilizers as the carrier. Dry fertilizers may also be used as a carrier when impregnated by licenced fertilizer dealers. To prevent chemical loss and reduced weed control, EPTC/R25788 should be uniformly incorporated into the soil by setting the incorporation equipment (i.e., tandem disks, field cultivator with sweep teeth, or vibrating shank S-tine cultivator) to work the soil approximately 10 cm deep, followed by a levelling device. Irrigation (approximately 0.6 cm) can also be used to incorporate. When application and incorporation are done in separate operations, application should be to a dry soil surface and incorporation should be made within 4 hours of application. Preplant incorporated EPTC+ may be used in tank mix combination with 1) atrazine for additional broadleaf weed control or 2) metolachlor using reduced rates of both herbicides for more consistent control of many annual grasses. **Residual Activity:** Provides season-long weed control with no soil residues the following year to prevent crop rotation. In tank mix combinations with atrazine, there may be atrazine residues when the highest atrazine rate is used. **Unique Characteristics:** EPTC/R25788 does not need rainfall to be activated and will not leach significantly under heavy rainfall.

ETHALFLURALIN

Trade Name: EDGE. **Chemical Family:** Dinitroanaline. **Crop and/or Non-Crop Registrations:** Soybeans, dry beans (white or kidney) and canola (rapeseed). **Sensitive Weeds:** Provides excellent control of annual grasses and good control of pigweed and lamb's-quarters, including the triazine-resistant biotypes of these weeds. Will also provide suppression of nightshade and lady's-thumb. **Uptake and Translocation:** No significant absorption or translocation of ethalfluralin in crops grown in soil treated with ethalfluralin. Susceptible weeds are controlled as they germinate. Established weeds are not controlled. **Basis of Selectivity:** Physiological growth processes associated with seed germination. **Application Methods:** Preplant incorporated. Apply in 100–300 L of water/ha. Use lower rates of the chemical on sandy soils and increasing rate for loam to clay soils. Do not use on highly organic soils (muck, peat or black sands above 15% organic matter). Vigourous, continuous agitation is essential for proper mixing. All in-line screens should be 50-mesh or coarser. Incorporate twice in cross directions using a tandem disc (7–10 km/hr) or tine cultivator (10–13 km/hr) set to work 8–10 cm deep. The first incorporation should be done as soon as possible after application, but may be delayed up to 24 hours. The second incorporation is recommended anytime before planting. Activated upon incorporation; rainfall is not required. **Residual Activity:** Recommended application rates provide season-long weed control. Succeeding crops, even fall-seeded grain crops planted in soil that received ethalfluralin the preceding spring, will not be injured under normal conditions. **Unique Characteristics:** Strongly adsorbed to soil particles and shows negligible leaching. Organic matter and clay content influence application rate.

ETHAMETSULFURON-METHYL

Trade Name: MUSTER. **Chemical Family:** Sulfonyl urea. **Crop and/or Non-Crop Registrations:** Spring Canola. **Sensitive Weeds:** Wild mustard. **Uptake and Translocation:** Following foliar application, is rapidly absorbed and translocated in both xylem and phloem. **Basis of Selectivity:** Inhibition of acetolactate synthase in susceptible plants leads to a rapid cessation of cell division and growth. Tolerant species rapidly convert ethametsulfuron-methyl to non-phytotoxic metabolites. **Application Methods:** Postemergence. **Residual Activity:** Rapid soil microbial degradation. **Unique Characteristics:** A non-ionic surfactant must be added. Typical symptoms of plant death (leaf crinkling, curling, chlorosis) occur 5–10 days after application depending on growing conditions.

ETHOFUMESATE

Trade Name: NORTRON. **Crop and/or Non-Crop Registrations:** Sugar beets. **Sensitive Weeds:** Chickweed, lamb's-quarters, kochia, redroot pigweed, Russian thistle, wild buckwheat, barnyard grass, large crab grass, foxtails and downy brome. **Uptake and Translocation:** Readily absorbed by emerging shoots (grass coleoptile and broadleaf hypocotyl) and roots, and translocated readily to the foliage. Postemergence applications of ethofumesate are poorly absorbed by maturing leaves with a well-developed cuticle. **Basis of Selectivity:** Tolerant species conjugate the herbicide, rendering it inactive. **Application Methods:** Preplant incorporated, preemergence. **Residual Activity:** Half-life of less than 5 to more than 14 weeks depending on soil temperature and moisture conditions. Half-life increases in cooler, drier soils.

FENOXAPROP-P-ETHYL

Trade Name: EXCEL SUPER, ACCLAIM SUPER. **Chemical Family:** Aryloxyphenoxypropionate. **Crop and/or Non-Crop Registrations:** EXCEL

NB: Trade names and common names of herbicides are cross-referenced in Table 1.

SUPER — Asparagus, broccoli, cabbage, cauliflower, carrots, dry common beans (kidney, pinto and white only), onions (dry bulb only), peas (field and processing), potatoes, canola (rapeseed), triazine-tolerant canola, soybeans, tomatoes. ACCLAIM SUPER — Lawns and Turf. **Sensitive Weeds:** Barnyard grass, green and yellow foxtail, crab grass, witch grass, wild proso millet, fall panicum, volunteer corn. **Uptake and Translocation:** Uptake primarily through the leaves. Does not translocate significantly. **Basis of Selectivity:** Differential metabolism by tolerant vs. sensitive species. **Application Methods:** Non-residual postemergence for the control of annual grasses (EXCEL SUPER — 1- to 6-leaf stage; ACCLAIM SUPER — 1- to 4-leaf stage plus 3 tillers). For best results, apply when weeds are young and actively growing. EXCEL SUPER — Do not apply if rainfall is expected within 1 hour of application. ACCLAIM SUPER — Do not apply if rainfall is expected within three hours of application. **Residual Activity:** Essentially none. **Unique Characteristics:** EXCEL can be tank mixed with BASAGRAN FORTE and/or PINACLE for broad-spectrum annual weed control in soybeans and dry beans only. If annual grasses are in the correct stage for application before broadleaf weeds have emerged, do not delay EXCEL SUPERapplication.

FIGHTER F

Type of Adjuvant: Antifoamer-Defoamer. **Chemical Composition:** Dimethyl-polysiloxane 10%. **Registered Uses:** To control foam in water, oil, fertilizer and pesticide spray mixtures. **Benefit:** Controls foam when mixing sprays, eliminates material waste, provides more accurate metering of agricultural sprays, and eliminates foam overflow at fill site. **Mixing:** To control foam when mixing spray solution, add defoamer either just before or during addition of any other spray adjuvant. To cut existing foam, add defoamer to tank and recirculate solution until foam dissipates.

FLUAZIFOP-P-BUTYL

Trade Names: FUSILADE II, VENTURE 25G. **Chemical Family:** Aryloxy-phenoxypropionate. **Crop and/or Non-Crop Registrations:** FUSILADE II —Flax, canola, soybeans, sugar beets, sunflowers, tobacco, forage legumes (alfalfa, red clover and bird's-foot trefoil), cabbage, broccoli, brussel sprouts, califlower, cucumber, onions, potatoes, rutabagas, tomatoes, highbush blueberries, raspberries, strawberries, non-grassy ornamental plants, poplars, shrubs, trees, apples, apricots, cherries, cranberries, peaches, pears and plums, forest and ornamental nurseries. VENTURE 25G — canola, alfalfa and soybeans. **Sensitive Weeds:** Annual grass species, volunteer corn, wheat, barley and quack grass. **Uptake and Translocation:** Absorbed primarily by leaves. Translocated to roots and rhizomes. **Basis of Selectivity:** Metabolism by tolerant species. **Application Methods:** Postemergence. Apply when grasses are actively growing, and annual grasses are in the 2- to 5-leaf stage and quack grass is in the 3- to 5-leaf stage. **Residual Activity:** Essentially none. **Unique Characteristics:** Preplant tillage to break up rhizomes will improve control of quack grass. Except as noted on the label, broadleaf herbicides should be applied separately at least 3 days after fluazifop-p-butyl. Do not cultivate for 5 days after applying fluazifop-p-butyl. When plants are stressed (lack of moisture, excessive humidity, low temperature and/or very low relative humidity), fluazifop-p-butyl is less effective. Regrowth by tillering may occur if application is made under any of the above conditions. Since there is no residual activity, a new flush of weeds may emerge after the first flush has been controlled.

FLUMETSULAM/CLOPYRALID

Trade Name: FIELDSTAR. **Chemical Family:** Triazolopyrimidine sulfonanilide/ pyridine. **Crop and/or Non-Crop Registrations:** Field corn. **Sensitive Weeds:** Common lamb's-quarters, redroot pigweed, Eastern black nightshade, common ragweed, velvetleaf, lady's-thumb. **Uptake and Translocation:** Flumetsulam and clopyralid are absorbed by both roots and shoots of germinating broadleaf weeds. **Basis of Selectivity:** Selectivity of flumetsulam in corn is based on metabolism. Basis of selectivity of clopyralid not established. **Application Methods:** Surface preplant, preplant incorporated, preemergence or early postemergence. **Residual Activity:** The most significant means of dissipation of both clopyralid and flumetsulam is microbial degradation. Provides season-long residual control of annual broadleaf weeds. Rotational crops are winter wheat, spring wheat, spring barley, oats, soybeans, field corn and seed corn. **Unique Characteristics:** Can be applied up to 15 days before planting. Recommended corn planting depth is at least 4 cm. Rainfall within 7–10 days is required for maximum activity of a surface preplant, preemergence or early postemergence application. Early postemergence applications can be made up to the 2-leaf stage of corn. Do not apply to areas where the soil pH is less than 5.9 or greater than 7.8. Apply only to soils containing between 2%–5% organic matter. Do not apply to corn treated with a granular organophosphate insecticide as serious crop injury may occur. Do not apply when air temperature is near freezing or when freezing conditions are expected for several days following time of application. Extended cold, wet conditions (soil temperatures below 10°C for extended periods) or abnormally high soil moisture conditions during emergence and early crop development can cause injury symptoms on corn such as temporary yellowing of the leaves and/or crop stunting. Corn will quickly outgrow these symptoms once normal growing conditions resume. Do not apply to sweet corn, seed corn or popcorn.

FLUMETSULAM/CLOPYRALID/2,4-D

Trade Name: MAX (available only in ULTIMAX co-pack), STRIKER. **Chemical Family:** Triazolopyrimidine sulfonanilide/ Pyridine/ Phenoxy. **Crop and/or Non-Crop Registrations:** Field corn. **Sensitive Weeds:** Lamb's-quarters, redroot pigweed. Eastern black nightshade, common ragweed,

velvetleaf, common chickweed, lady's-thumb. **Uptake and Translocation:** Flumetsulam, clopyralid and 2,4-D are absorbed by both roots and shoots of emerged and germinating broadleaf weeds. **Basis of Selectivity:** Selectivity of flumetsulam in corn is based on metabolism. Basis of selectivity of clopyralid and 2,4-D not established. **Application Methods:** Postemergence. **Residual Activity:** The most significant means of dissipation of flumetsulam, clopyralid and 2,4-D is microbial degradation. If adequate rainfall is received following application, STRIKER will provide residual control of late-germinating broadleaf weeds. Rotational crops are winter wheat, spring wheat, spring barley, oats, soybeans, common beans (dry, snap), lima beans, field corn and seed corn. **Unique Characteristics:** Do not apply beyond the 6-leaf stage of corn as serious crop injury may occur. Do not apply to corn treated with a granular organophosphate insecticide as serious crop injury may occur. Do not apply when air temperature is near freezing or when freezing conditions are expected within several days after time of application. Do not apply to sweet corn, seed corn or popcorn.

FLUMETSULAM/METOLACHLOR

Trade Name: BROADSTRIKE DUAL. **Chemical Family:** Triazolopyrimidine sulfonanilide/acetanilide. **Crop and/or Non-Crop Registrations:** Soybeans. **Sensitive Weeds:** Common lamb's-quarters, redroot pigweed, Eastern black nightshade, American nightshade, common ragweed, velvetleaf, cocklebur, barnyard grass, crab grass (smooth, hairy), foxtail (green, yellow, giant), fall panicum, old witch grass, yellow nut sedge. **Uptake and Translocation:** Flumetsulam and metolachlor are absorbed by both roots and shoots of germinating broadleaf weeds. Metolachlor absorbed by germinating grasses mainly through shoot just above seed. **Basis of Selectivity:** Selectivity of flumetsulam in soybeans is based on metabolism. Basis of selectivity of metolachlor not established. **Application Methods:** Surface preplant, preplant incorporated or preemergence. **Residual Activity:** The most significant means of dissipation of both metolachlor and flumetsulam is microbial degradation. Provides season-long residual control of annual broadleaf and grass weeds. Rotational crops are winter wheat, spring wheat, spring barley, soybeans, common beans (dry, snap), lima beans, peas, field corn, seed corn. **Unique Characteristics:** Can be applied up to 21 days before planting. Rainfall within 7–10 days is required for maximum activity of a preemergence application. Do not apply to areas where the soil pH is greater than 7.8 and organic matter is less than 2%. Do not apply to soils containing more than 5% organic matter. Suspension concentrate formulation separates into two phases over time. Shake container well before using.

FLUMETSULAM/TRIFLURALIN

Trade Name: BROADSTRIKE TREFLAN. **Chemical Family:** Triazolopyrimidine sulfonanilide/dinitroaniline. **Crop and/or Non-Crop Registrations:** Soybeans. **Sensitive Weeds:** Common lamb's-quarters, redroot pigweed, Eastern black nightshade, common ragweed, velvetleaf, cocklebur, barnyard grass, crab grass (smooth, hairy), foxtail (green, yellow), fall panicum, annual bluegrass, loose silky bentgrass, bromegrass. **Uptake and Translocation:** Flumetsulam is absorbed by both roots and shoots of germinating broadleaf weeds. No significant absorption or translocation of trifluralin. Susceptible weeds are controlled as they germinate. **Basis of Selectivity:** Selectivity to trifluralin is based on morphological characteristics of soybeans. Selectivity of flumetsulam in soybeans is based on metabolism. **Application Methods:** Preplant incorporated. Must be incorporated within 24 hours after application. **Residual Activity:** The most significant means of dissipation of both trifluralin and flumetsulam is microbial degradation. Provides season-long residual control of annual broadleaf and grass weeds. Rotational crops, spring wheat, spring barley, soybeans, common beans (dry, snap), lima beans, peas, field corn, seed corn. **Unique Characteristics:** Can be applied up to 21 days before planting. Do not apply to natto soybean varieties as serious crop injury may occur. Do not apply to areas where (both apply) the soil pH is greater than 7.8 and organic matter is less than 2%. Do not apply to soils containing more than 5% organic matter. Suspension concentrate formulation separates into two phases over time. Shake container well before using.

FOMESAFEN

Trade Name: REFLEX. **Chemical Family:** Diphenyl ether. **Crop Registrations**: Soybeans, beans (white, kidney and snap). **Sensitive Weeds:** Redroot pigweed, common ragweed, wild mustard, lady's-thumb, black nightshade, cocklebur; suppression of velvetleaf, lamb's-quarters. **Uptake and Translocation:** Taken up through foliage. Not readily translocated. **Mode of Action:** Cell-membrane disrupter. **Method of Selectivity**: Beans metabolize fomesafen. Some initial bronzing of crop leaves may occur, but plants normally outgrow this condition without any effect on maturity or yield. **Application Method**: Early postemergence to weeds and crop. Apply when beans are 1–2 trifoliate and weeds are at the 2- to 4-leaf stage. Good coverage is essential for optimum weed control. Apply in 200–350 L of water/ha at a pressure between 245–420 kPa. Always add an adjuvant such as AGRAL 90 (0.25% v/v) or TURBOCHARGE (0.5% v/v). PINNACLE or VENTURE may be tank mixed for additional weed control. **Residual Activity:** Persistence depends on weather and soil conditions (more persistent under dry conditions). Rotation to field corn, dry beans or soybeans the following year. Winter wheat may be planted 90 days after treatment. All other crops require a field bioassay. **Unique Characteristics:** Do not apply REFLEX to any field more than once every 2 years.

FOSAMINE AMMONIUM

Trade Name: KRENITE. **Chemical Family:** Carbamoyl phosphonate. **Crop and/or Non-Crop**

Registrations: Vine and brush control on non-crop land. **Sensitive Weeds:** Control and growth suppression of blackberry, oak, pine, sumac, maple, elder, elm, wild rose, hazel, aspen and beech. Cedar and spruce are quite tolerant. **Uptake and Translocation:** Absorption by young stems and foliage. Translocation has been observed from a treated mature leaf to all other parts of a plant but phloem transport with sugars is predominant. **Basis of Selectivity:** Not highly selective. **Application Methods:** Postemergence. Apply with high pressure ground equipment to ensure penetration of spray to thoroughly wet leaves, buds, stems and trunks of target brush. Surfactants are recommended to promote rapid leaf penetration. **Residual Activity:** Essentially none. **Unique Characteristics:** Woody plants treated with fosamine ammonium die very slowly; the stems may not be completely killed 2 years after treatment; the unsightly brown-out effect common to many other herbicides does not occur. Rainfall within 24 hours of application may decrease effectiveness.

FUMIGANTS

(See METAM SODIUM, METHYL-BROMIDE/CHLOROPICRIN, METHYL ISOTHIOCYANATE/DICHLOROPROPENE, METHYL ISOTHIOCYANATE/ DICHLOROPROPENE/CHLOROPICRIN)

GLUFOSINATE AMMONIUM

Trade Name: IGNITE, LIBERTY 200SN. **Chemical Family:** Unique. **Crop and/or Non-Crop Registrations:** IGNITE -Desiccation of dry beans and potatoes; directed applications in apples, grapes, peaches, pears and plums; stale seedbed techniques in asparagus, carrots, lettuce and onions; ground crack application in potatoes. LIBERTY 200SN - Corn hybrids specially developed to be tolerant to Liberty 200SN herbicide. Glufosinate-ammonium tolerant inbred lines grown for seed corn production. **Sensitive Weeds:** Non-selective — affects all actively growing green plants; regrowth of perennial species may occur. **Uptake and Translocation:** absorbed through foliage; minimal translocation — dependent on application rate and species treated. **Basis of Selectivity:** IGNITE — All green plant tissue is sensitive; safe on mature (non-green) bark of woody plants. LIBERTY 200SN — All green plant tissue is sensitive except for field corn and seed corn plants that have been specially developed to be tolerant. **Application Methods:** IGNITE — Post-emergence; broadcast or directed spray to avoid contact with leaves or green bark of desirable plants; thorough coverage of the plant tissue to be controlled is essential. LIBERTY 200SN — Postemergence, broadcast 1 to 8 leaf stage. **Residual Activity:** None; there are no cropping or rotational restrictions after application. **Unique Characteristics:** Speed of action is influenced by environmental factors; at cool temperatures, poor moisture and low humidity, speed of action may be reduced. Heavy dew at time of application may reduce control of certain weed species.

GLYPHOSATE TMS

Trade Name: TOUCHDOWN 480. See glyphosate.

GLYPHOSATE

Trade Names: CLEAR-IT 1, CLEAR-IT 2, CLEAR-IT 3, EXPEDITE GRASS & WEED, E-Z-JECT, GLYFOS, LAREDO, RENEGADE, ROUNDUP, ROUNDUP DRY, ROUNDUP L & G, ROUNDUP TRANSORB, TOUCHDOWN 480, VISION, WRANGLER. **Chemical Family:** Amino acid. **Crop and/or Non-Crop Registrations:** GLYFOS, LAREDO, RENEGADE, ROUNDUP, ROUNDUP TRANSORB, WRANGLER — preplant or post-harvest with no cropping restrictions. Preharvest in wheat, barley, soybeans, canola, flax, lentils, peas and forages. TOUCHDOWN 480 for preharvest use in canola, barley, field beans, field peas, soybeans and wheat. Directed applications in ginseng, cherries, grapes, apples, pears, plums and peaches, strawberries as wiper or spot treatment. Non-crop registrations: EXPEDITE GRASS & WEED, ROUNDUP — brush control; turf renovation; chemical mowing; directed application in woody nursery stock, roadsides and shelterbelts. ROUNDUP - asparagus. E-Z-JECT — selective woody brush and tree control. VISION — silvicultural site preparation, conifer release, forest tree plantings, forest tree nurseries. **Sensitive Weeds:** Annual grasses; perennial weeds (quack grass, Canada thistle, sow-thistle, field bindweed, milkweed, cattails, nut sedge, poison-ivy etc.); brush (birch, alder, poplar, raspberry, willow and maple. **Uptake and Translocation:** Absorbed through foliage and translocated throughout the plant. **Basis of Selectivity:** Non-selective for agricultural crops. Conifers are tolerant at some stages but the basis has not been established. **Application Methods:** Postemergence, usually at the bud to bloom stage of growth for most perennial weeds. Canada thistle should be at least in early flower bud, milkweed at flower bud, and bindweed at full flower. Quack grass can be treated in the spring or fall when it is actively growing with at least 3–4 new leaves on each emerged shoot; in the fall, remove crop refuse but do not till prior to application; fall or spring tillage prior to spring application may reduce control; wait at least 3–5 days after application before working the area; for maximum control it is advisable to till before the quack grass turns completely brown. Glyphosate can be applied with boom equipment, knapsack sprayers and high-volume equipment for agricultural and non-crop uses. Backpack mist blowers may be used for silvicultural site preparation and roadside brush control only. Aerial applications may be used for silvicultural site preparation and conifer release only. Can also be applied with selective equipment for non-crop areas, tree plantings, grapes and orchards (See sections entitled "Special Methods of Weed Control" and "Selective Weed Control with Wiper Applicators"). Regardless of method of application, do not allow herbicide solution to contact green foliage or green bark of crop or other desirable plants; remove all suckers from the trunks of desirable trees before spraying. **Residual Activity:** None: crops can be planted or seeded directly into treated areas following

application. Other herbicides are required to control weeds emerging after the application. **Unique Characteristics:** Rainfall within 6 hours after application or heavy frost within 24 hours may reduce control. ROUNDUP TRANSORB is rainfast as soon as 4 hours after application.

GLYPHOSATE/GLUFOSINATE AMMONIUM

Trade Name: ROUNDUP FASTFORWARD PRESEED, ROUNDUP FASTFORWARD PREHARVEST. **Chemical Family**: Amino acid/Unique. **Crop and/or Non-Crop Registrations:** ROUNDUP FASTFORWARD PRESEED - Preplant treatments with no cropping restrictions. ROUNDUP FASTFORWARD PREHARVEST - Preharvest treatments in wheat, drybeans, canola, flax, peas, and lentils. **Sensitive Weeds**: Annual grass and broadleaf weeds and many perennials such as quack grass and Canada thistle. **Translocation:** Absorbed through foliage and translocated throughout the plant. **Basis of Selectivity:** Non-selective for agricultural crops. **Application Methods**: Postemergence to actively growing weeds using boom equipment (see glyphosate note for more information). **Residual Activity:** None: Crops can be planted directly into the treated areas following application. **Unique Characteristics**: Glyphosate/glufosinate ammonium provides quicker burndown of green vegetation than glyphosate alone. Rainfall within 2 hours after application or a heavy frost within 24 hours may reduce control.

HALT

Type of Adjuvant: Defoamer. **Chemical Composition:** Silicone base, neutral. **Registered Uses:** To reduce foaming when preparing herbicide spray mixes. **Benefit:** The reduction of foaming allows faster tank fill-ups, ensures correct fill volumes, reduces the possibility of chemical overflow and gives more accurate herbicide application. **Mixing:** Add 7 mL/500 L of spray mix. May be added to spray tank during filling to prevent foaming, or after to cut foam. **Unique Characteristics:** May be used with any herbicide unless contraindicated on the label.

HERBICIDAL OIL

(See MINERAL OIL [HERBICIDAL].)

HEXAZINONE

Trade Names: PRONONE, VELPAR. **Chemical Family:** Triazine. **Crop and/or Non-Crop Registrations:** Christmas trees, coniferous reforestation, non-crop land. **Sensitive Weeds:** Most herbaceous broadleaf weeds and grasses including raspberry, bluejoint grass, goldenrod and brome grass; spot applications control aspen, ash, maple, cherry and birch. **Uptake and Translocation:** Absorbed through roots and foliage; translocation is primarily upwards through xylem. **Basis of Selectivity:** Tolerant species metabolize hexazinone faster than sensitive species. For conifers, at least part of the selectivity is due to the tree roots being deeper than hexazinone leaches into the soil. **Application Methods:** For broadcast applications, apply preemergence or as a postemergence foliar spray during active plant growth. For spot applications, use an exact- delivery hand gun applicator to apply undiluted VELPAR-L as close as possible to the root collar of plants to be controlled; keep spots at least 1 m away from desirable conifers. Apply PRONONE with an approved granular applicator. **Residual Activity:** Half-life of 2 months on a Flanagan silt loam in Illinois. Half-life of 2 1/2 months on a silty clay in northern Ontario. **Unique Characteristics:** Rainfall is needed to activate hexazinone in the soil. Do not use on sandy, gravelly or rocky soils, or on frozen ground. Do not apply on steep slopes. Do not apply to areas where the roots of desirable trees may extend. Liquid formulation is flammable. A bioassay may be used to determine soil residue levels when sensitive crops are to be planted in soil treated with hexazinone.

IMAZAMOX

Trade Name: VIPER (Available only in VIPER co-pack).

IMAZAMOX+FOMESAFEN

Trade Name: VIPER (co-pack of VIPER+REFLEX). **Chemical Family**: Imidazolinone+diphenyl ether. **Crop Registrations**: Soybeans. **Sensitive Weeds:** Annual grass (barnyard grass, green and yellow foxtail, witch grass) and broadleaf (cocklebur, lamb's-quarters, pigweed, ragweed, velvetleaf, lady's-thumb, mustards, nightshades) species including triazine resistant biotypes **Uptake and Translocation:** Contact and systemic. Absorption occurs through foliage and roots. **Basis of Selectivity:** Metabolism by soybeans. **Application Methods**: VIPER is a postemergent program and should be applied to actively growing weeds in the cotyledon to 6 true-leaf stage once soybeans have reached the first trifoliate stage. Addition of a non-ionic surfactant and liquid fertilizer solution are required. VIPER also provides control of some late-emerging weeds. **Residual Activity:** Rotational crops include field corn, soybeans, winter wheat. **Unique Characteristics**: Some rotational restrictions apply (See label for details).

IMAZAPYR

Trade Name: ARSENAL. **Chemical Family:** Imidazolinone. **Crop and/or Non-Crop Registrations:** Non-crop/non-graze areas such as industrial sites, railroad ballast, spot treatments for rail and highway rights-of-way and pipeline rights-of-way

NB: Trade names and common names of herbicides are cross-referenced in Table 1.

stations including well sites, battery stations and compressor or valve stations. **Sensitive Weeds:** Annual and perennial grass and broadleaf weeds such as: annual — black medick, rough cinquefoil, common groundsel, hemp-nettle, kochia, lamb's-quarters, mustard spp., pigweed spp., pineappleweed, ragweed spp., Russian thistle, stinkweed, annual sow-thistle, wild buckwheat, annual bluegrass, foxtail spp., witch grass; biennial/perennial — bladder campion, bull thistle, burdock, Canada thistle, sulfur cinquefoil, clover spp., dandelion, dog-strangling vine, field bindweed, goat's beard, goldenrod, leafy spurge, milkweed, mouse-eared chickweed, mullein spp., ox-eye daisy, plantain spp., poison-ivy, sheep sorrel, toadflax, tufted vetch, wild carrot, wild grape, wild strawberry, brome grass, Canada bluegrass, fescue spp., quack grass, yellow nut sedge; Seedling woody species — maple, poplar, raspberry and wild rose. **Uptake and Translocation:** Absorbed by both roots and foliage of sensitive vegetation. Translocated in both the xylem and phloem. **Basis of Selectivity:** None. **Application Methods:** Postemergence on actively growing weeds. Control of non-emerged sensitive species will also be provided in the year of application. Apply in 100–550 L of water/ha with high-volume, high-pressure handguns and vehicle-mounted directed-spray equipment or conventional boom-mounted, manifold-mounted or off-centred nozzles. Low-volume, hand-held backpacks, knapsacks or other pump-up-type sprayers may also be used for direct applications to foliage. Addition of non-ionic surfactant at 1 L/400 L of spray solution is recommended for spray volumes greater than 550 L/ha. A foam-reducing agent may be added at the recommended rate, if required. **Residual Activity:** Season-long control of sensitive species. **Unique Characteristics:** Do not contaminate ponds, lakes, streams, wetlands or sloughs and do not apply within 15 m of a wetland area or body of water. Do not mix or store in unlined steel (except stainless steel) containers or spray tanks. For ground application only. Do not use where roots from desirable vegetation may extend into the treated area (maintain a distance from desirable trees equal to at least twice the distance from the trunk to the dripline). To be used by licensed applicators only.

IMAZETHAPYR

Trade Name: CONQUEST B (Available only in CONQUEST co-pack), PURSUIT. **Chemical Family:** Imidazolinone. **Crop and/or Non-Crop Registrations:** Soybeans, white beans, kidney beans, snapbeans, imidazolinone-tolerant corn (IR), processing peas and alfalfa for seed production. **Sensitive Weeds:** Soil applications — green foxtail, yellow foxtail, old witch grass, barnyard grass, lamb's-quarters, redroot pigweed, smartweed, lady's-thumb, wild mustard, velvetleaf, common ragweed and reduced competition from eastern black nightshade and proso millet. Postemergence application — green foxtail, yellow foxtail, witch grass, barnyard grass, redroot pigweed, velvetleaf, wild mustard, cocklebur, eastern black nightshade, ragweed and reduced competition from proso millet, large crab grass, lamb's-quarter's, wild buckwheat and yellow nut sedge. Late postemergence application — green and yellow foxtail (up to 4-leaf stage), barnyard grass (up to 6-leaf stage), redroot pigweed (up to 12-leaf stage) and velvetleaf (up to 8-leaf stage). **Uptake and Translocation:** Absorbed by both roots and foliage. Translocation in both xylem and phloem. **Basis of Selectivity:** Metabolism by tolerant species. **Application Methods:** Early preplant (up to 30 days before planting), preplant incorporated, preemergence and postemergence up to the 2-leaf stage of weeds, and late postemergence on specific weeds (see Sensitive Weeds). **Residual Activity:** Persistence depends on weather and soil conditions (more persistent under dry conditions). Rotational cropping restricted to soybeans, white beans, kidney beans, processing peas, corn, spring barley, spring wheat and winter wheat. Do not plant other crops the year following application as injury may result. **Unique Characteristics:** Can be applied up to 30 days prior to planting. Registered for use in reduced and no-till situations. Tank mixing is recommended for heavy infestations of ragweed or barnyard grass. Postemergence application requires the addition of AGRAL 90, AGSURF or ENHANCE surfactant and liquid fertilizer solution. Temporary soybean discoloration and/or shortening may occur with postemergence applications. A period of 100 days is required between application and planting winter wheat.

IMAZETHAPYR/ATRAZINE

Trade Name: PATRIOT. **Chemical Family:** Imidazolinone/s-triazine **Crop and/or Non-Crop Registrations:** Imazethapyr tolerant corn. **Sensitive Weeds** Annual grass and broadleaf species inlcuding triazine resistant biotypes. See label for specific species controlled. **Application Methods:** Postemergence. **Unique Characteristics:** Some rotational restrictions apply. See label for details. Refer to notes on imazethapyr and atrazine for additional information on each component.

IMAZETHAPYR+METRIBUZIN

Trade Name: CONQUEST (co-pack of CONQUEST A + CONQUEST B). **Chemical Family:** Imidazolinone+s-triazine. **Crop and/or Non-Crop Registrations:** Soybeans. **Sensitive Weeds:** Annual grass and broadleaf species. See label for specific species controlled. **Application Methods:** Preplant incorporated and preemergence. **Unique Characteristics:** Some rotational restrictions apply. See label for details. Refer to notes on imazethapyr and metribuzin for additional information on each component.

IMAZETHAPYR/PENDIMETHALIN

Trade Name: VALOR. **Chemical Family:** Imidazolinone/dinitroaniline. **Crop and/or Non-Crop Registrations:** Soybeans. **Sensitive Weeds:** Annual grass and broadleaf species including triazine-resistant biotypes. See label for specific species controlled. **Application Methods:** Preplant incorporated. **Unique Characteristics:** Some rotational restrictions apply. See label for details.

Refer to notes on imazethapyr and pendimethalin for additional information on each component.

ISOXABEN

Trade Name: GALLERY. **Chemical Family:** Benzamide. **Crop and/or Non-Crop Registrations:** Bareroot and container conifer seedlings. **Sensitive Weeds:** St. John's-wort, pineappleweed, lamb's-quarters, purslane, shepherd's-purse, low cudweed and purslane speedwell. **Uptake and Translocation:** Absorbed by roots and translocated to the shoots of germinating weeds. **Basis of Selectivity:** Root selectivity. **Application Methods:** Applied prior to weed emergence in conifers, 4 or more weeks after crop germination and emergence. Rainfall or irrigation is needed to activate the herbicide. **Residual Activity:** Provides season-long control. Germination of some sensitive crop species may be reduced in the year following treatment. **Unique Characteristics:** Gallery is registered for use only by members of the Canadian Forest Nursery Weed Management Association.

KORNOIL

Type of Adjuvant: Mineral oil (non-herbicidal). **Chemical Composition:** 98.5% mineral oil, 1.5% emulsifier. **Registered Uses:** (Crop/herbicide): Corn/atrazine. **Benefit:** Improved postemergence activity of atrazine. **Mode of Action:** Partially dissolves waxy cuticle of weeds allowing atrazine to penetrate more readily. **Mixing:** Fill spray tank with water allowing space for subsequent addition of atrazine and oil; engage agitation and pour in premixed slurry of atrazine in water; add KORNOIL last. Avoid excessive agitation of the spray mix as this may cause coagulation or buttering out. **Unique Characteristics:** To prevent a build-up of oil in the sprayer, empty the tank as completely as possible before refilling. Some injury may occur if the crop is stressed (cold weather or hot, dry weather).

KORNOIL CONCENTRATE

Type of Adjuvant: Mineral oil/surfactant (non-herbicidal). **Chemical Composition:** Paraffin-base mineral oil 85%, surfactant blend 15%. **Registered Uses:** To be blended with atrazine/water mixtures and applied postemergence in corn. **Benefit:** Improved postemergence activity of atrazine. **Mode of Action:** Partially dissolves waxy cuticle of weeds allowing atrazine to penetrate more readily. Also reduces evaporation and aids in spreading of spray droplets on the leaf surface leading to a longer period for penetration. **Mixing:** Avoid violent agitation; partially fill sprayer, add atrazine slurry, add KORNOIL CONCENTRATE last. **Unique Char-acteristics:** Some injury may occur with cold, rainy weather.

LI700

Type of Adjuvant: Non-ionic surfactant and pH Adjuster/Acidifier. **Chemical Composition:** Phosphatidylcholine, meth-ylacetic acid and alkyl polyoxyethylene ether 80%. **Registered Uses:** As a penetrating surfactant; as a pH adjuster/acidifier; for use with glyphosate products such as ROUNDUP, LAREDO, RENEGADE, WRANGLER and VISION. Alkaline water, even mildly alkaline, causes alkaline hydrolysis or degradation of many pesticides. Some chemicals degrade in less time than it takes to put out a tank of spray. When mixed with spray solutions, LI700 neutralizes or slightly acidifies the spray solution and prevents the breakdown hydrolysis of pH-sensitive products in the spray tank. Add LI700 before adding the pesticide. **Benefit:** Improves chemical effectiveness. **Mixing:** As a penetrating surfactant: Use 5 L of LI700/1000 L spray mixture or 500 ml of LI700/100 L spray mixture. As a pH adjuster/acidifier: Highly alkaline water, (pH 8 or higher), Use: 625 ml–1.25L LI700/1000 L water mixture.

LINURON

Trade Name: AFOLAN F, LINURON 480, LOROX DF, LOROX L. **Chemical Family:** Substituted urea. **Crop and/or Non-Crop Registrations:** Corn, soybeans, carrots, celery, dill, parsnips, potatoes, asparagus, wheat, oats, barley, gladioli, fruit trees. **Sensitive Weeds:** Annual weeds such as barnyard grass, common chickweed, corn spurry, crab grass, velvetleaf, fall panicum, foxtail, goosefoot, goose grass, groundsel, knotweed, lamb's-quarters, redroot pigweed, purslane, common ragweed, shepherd's-purse, smartweed, stinkweed, wild buckwheat, witch grass, wormseed mustard, triazine-resistant weeds; seedlings only of dandelion, plantain and sow-thistle. **Uptake and Translocation:** Readily absorbed through roots, less so through foliage; translocation primarily upwards in xylem. **Basis of Selectivity:** Differencial metabolism often coupled with differential uptake and translocation. **Application Methods:** Preemergence, postemergence, directed postemergence, pre plus postemergence. **Residual Activity:** Does not pose a problem for subsequent crops since phytotoxic residues from applications at agricultural rates disappear within 4 months. **Unique Characteristics:** Do not use on sandy or coarse-textured soils having less than 2% organic matter. If unusually heavy rains follow application, severe injury may occur to corn, soybeans, carrots and potatoes.

MALEIC HYDRAZIDE

Trade Name: ROYAL MH 60 SG. **Chemical Family:** Unique. **Crop and/or Non-Crop Registrations:** Growth control in lawns, turf, trees and shrubs. Sprout control in stored onions and potatoes. **Sensitive Weeds:** Controls the growth of wild onion, garlic and biennial-type weeds such as dandelion and plantain when applied in the fall. **Uptake and Translocation:** Absorbed through foliage. Translocated to active growing points in plant. Translocated more effectively downwards. **Basis of Selectivity:** Not established. **Application Methods:** Postemergence. Use as a foliar spray. Dosage and stage of plant development are critical factors. To reduce or eliminate mowing, apply in the spring or fall to green non-dormant grass; can be

mixed with 2,4-D for spring applications. For tree and shrub growth control, apply to the portion of the plant on which growth is to be inhibited; growth control is best when applied to vigourous new growth; spray leaves and bark to point of run-off. **Residual Activity:** None. **Unique Characteristics:** Do not apply on or near crops being grown for seed. Rain within 24 hours after application will reduce effectiveness. Since temporary discoloration of grass may result, this chemical is recommended for use in areas where mowing grass is difficult and where lawn-like appearance is not necessary.

MCPA

Trade Names: ESTEMINE, MCPA, MCPA-SODIUM SALT, MCPA AMINE. **Chemical Family:** Phenoxy. **Crop and/or Non-Crop Registrations:** Cereal crops, turf, non-crop sites. **Sensitive Weeds:** Many broadleaf weeds, especially buttercup, hemp-nettle, field horsetail (top growth only), seedling dock. **Uptake and Translocation:** Absorbed through leaves or roots. Translocates to, and accumulates at, growing points of shoots and roots. **Basis of Selectivity:** Differences in interception, penetration, translocation, metabolism and sensitivity of active sites leads to greater activity in broadleaf weeds than grasses. **Application Methods:** Post-emergence. **Residual Activity:** Some soil residues can be detected for up to 1 month under moist conditions and 2 months under drier conditions. **Unique Characteristics:** MCPA is available in amine ester or sodium salt formulations. It is safer than 2,4-D for use on oats, flax and peas. As with 2,4-D, there is a potential drift hazard to nearby susceptible crops such as grapes, turnips, tobacco and cabbage.

MCPB/MCPA

Trade Name: CLOVITOX PLUS, TROPOTOX PLUS. **Chemical Family:** Phenoxy/phenoxy. **Crop and/or Non-Crop Registrations:** Seedling white, ladino, alsike or red clovers direct seeded or underseeded in wheat, oats, barley, rye, pastures, field corn, peas, grapes. **Sensitive Weeds:** Small emerged mustards, stinkweed, ragweed, lamb's-quarters, redroot pigweed, shepherd's-purse, volunteer rapeseed, wild radish, hemp-nettle, annual sow-thistle; top-growth control of bull thistle, Canada thistle, curled dock, plantain, perennial sow-thistle, field bindweed, horsetail, buttercup. **Uptake and Translocation:** Absorbed through the foliage and readily translocated, especially to the growing points. **Basis of Selectivity:** MCPB is not directly toxic to plants. Susceptible weeds convert MCPB to MCPA. **Application Methods:** Postemergence. In cereals, clovers and peas, apply as an overall spray. In corn, apply with drop pipes after the corn reaches 45 cm before the beginning of tasselling. Apply to pastures after grazing or cutting.

MECOPROP

Trade Names: COMPITOX, MCPP, MECO-D, MECOPROP. **Chemical Family:** Phenoxy. **Crop and/or Non-Crop Registrations:** Cereals, turf. **Sensitive Weeds:** Many broadleaf weeds such as chickweed, cleavers, plantain, clover, corn spurry, stitchwort, black medick, knotweed, shepherd's-purse, buttercup, Canada thistle (top-growth control) and dandelion. For complete control of Canada thistle, dandelion and black medick, a repeat application will likely be required. **Uptake and Translocation:** Absorbed readily by foliage and translocated to roots and throughout shoots, especially to growing points. **Basis of Selectivity:** Differences in interception, penetration, translocation, metabolism and sensitivity of active sites result in broadleaf species being more sensitive than grasses. **Application Methods:** Postemergence. Apply to cereals between the 3-leaf and early flag-leaf stage. In lawns and turf, apply when weeds are actively growing (May, June and September). **Residual Activity:** Can persist in soil up to 4 weeks, however, grass can normally be seeded within 1–2 weeks after treatment. **Unique Characteristics:** Controls 2,4-D-resistant weeds such as chickweed, clovers, black medick and young knotweed. Do not spray on grain underseeded to legumes. If cereals are stressed at the time of application, deformed heads and missing florets may result. Can be safely used on bentgrass, however, injury may occur if temperature is above 27°C. Effectiveness will be reduced if rain occurs within 4–6 hours after treatment.

MECOPROP/2,4-D

Trade Names: EXPEDITE BROADLEAF, MECO-D, MECOPROP PLUS 2,4-D, MECOTURF PLUS 2,4-D, PREMIUM 2-WAY TURF HERBICIDE, TURF-RITE 2+2. **Chemical Family:** Phenoxy/phenoxy. **Uptake and Translocation:** Absorbed through leaves and roots, translocates to growing points. **Basis of Selectivity:** Differences in interception, penetration, translocation, metabolism and sensitivity of active sites result in broadleaf species being more sensitive than grasses. **Application Methods:** Postemergence. Apply when weeds are actively growing. EXPEDITE BROADLEAF is a ready-to-use formulation that must be applied with Expedite application equipment.

MERGE

Type of Adjuvant: Surfactant/solvent. **Chemical Composition:** 50% surfactant blend plus 50% solvent (petroleum hydrocarbons). **Registered Uses:** For use with sethoxydim. **Benefit:** Improves chemical effectiveness and provides a greater degree of consistency under varying environmental conditions. **Mode of Action:** Improves spreading of spray droplets on the leaf surface and increases contact surface area. Improves penetration of herbicide through the leaf cuticle layer. Acts as a protectant against photodegradation of sethoxydim by UV light. **Mixing:** Half-fill spray tank with water, start agitation. Add required amount of herbicide and continue agitation. Add MERGE, along with remaining water, last to the tank. Agitate thoroughly after any stoppage in spraying. **Unique Characteristics:** May cause temporary topical burn to crop plants under hot, humid weather conditions.

METAM SODIUM

Trade Name: VAPAM **Chemical Family:** Thiocarbamate. **Crop and/or Non-Crop Registrations:** Field and greenhouse seedbeds. Field-replant sites of fruits, vegetables, tobacco, ornamentals and forest-tree stock. **Sensitive Weeds:** Most scarified weed seeds and freshly vegetative parts including rhizomes and germinating seedlings. **Basis of Selectivity:** Most plant parts are sensitive. Crops are not planted until all fumigant has dissipated from the soil. With moisture, methyl isothiocyanate gas is released, which kills most scarified seeds and fleshy vegetative parts including rhizomes and germinating seedlings. **Application Methods:** Apply uniformly using injectors, water or other incorporation tools to carry the product to the desired soil depth. May be applied via the irrigation system. No gas-proof cover is required unless the soil is very porous, however, a sprinkler application of water should be used to provide a surface "water seal". **Residual Activity:** 10 to 40 days depending on soil temperature and the amount of organic matter present in the soil. Persistence is greatest at low temperatures and high levels of organic matter. Planting may take place 12 to 16 days after the treatment and following a lettuce-seedling bioassay that indicates no injury. **Unique Characteristics:** Also controls nematodes, soil fungi and soil insects. All traces of toxic gases must be dissipated from the treated soil before planting or plant injury may occur.

METHYL BROMIDE/CHLOROPICRIN

Trade Name: TERR-O-GAS 67. **Chemical Family:** Organohalogen. **Crop and/or Non-Crop Registrations:** Greenhouse and tobacco seedbeds. Methyl bromide is very poisonous to humans and livestock; only an experienced operator should attempt its use. **Sensitive Weeds:** Gas is toxic to germinating seedlings. **Application Methods:** Formulated as a liquid under pressure, that, when released from the container, forms a gas. Soil must be sealed with a plastic sheet since the gas is highly volatile. Refer to label for detailed directions. **Unique Characteristics:** Methyl bromide gas is highly volatile and highly poisonous to humans and livestock. It may be absorbed by inhalation, ingestion and skin contact. A permit must be obtained from the Ontario Ministry of the Environment each time it is used. Also controls soil insects, nematodes and fungal diseases.

METHYL ISOTHIOCYANATE/ DICHLOROPROPENE

Trade Name: VORLEX PLUS. **Chemical Family:** Thiocarbamate. **Crop and/or Non-Crop Registrations:** Preplant treatment in both field and greenhouse soils to be planted to: ornamental plants such as flowers and evergreens; vegetables such as celery, lettuce, beets, tomatoes, eggplant, beans, melons, onions, asparagus and squash; field crops such as tobacco, sugar beets, potatoes, ginseng; small fruits such as strawberries. **Sensitive Weeds:** All growing weed seedlings within the fumigated zone. Non-germinated seeds or established weeds may not be controlled. **Basis of Selectivity:** Non-selective. Gas is toxic to most young, green plant tissues. **Application Methods:** Injected into the soil 15–20 cm deep using special application equipment. The soil surface is sealed by either surface irrigation or physically compacting the soil surface. Cultivation of the fumigated soil after the desired period of time allows the gas to escape. **Residual Activity:** Varies with soil type but usually 4–6 weeks if left undisturbed. Aways check the soil for fumigant using the lettuce-seedling bioassay before planting a crop in it. **Unique Characteristics:** Also controls fungal diseases and unencysted nematodes.

METHYL ISOTHIOCYANATE/ DICHLOROPROPENE/ CHLOROPICRIN

Trade Name: VORLEX PLUS CP. **Unique Characteristics:** Chloropicrin provides added disease control to the mixture. See notes on METHYL ISOTHIOCYNANATE/ DICHLOROPROPENE.

METOBROMURON

Trade Name: PATORAN FL. **Chemical Family:** Substituted urea. **Crop and/or Non-Crop Registrations:** Soybeans, dry common beans (kidney, white, yellow-eye), lima beans, snap common beans, adzuki beans, potatoes. **Sensitive Weeds:** Annual broadleaf weeds (including triazine-tolerant biotypes) such as pigweed, lamb's-quarters, green smartweed, ragweed, lady's-thumb, shepherd's-purse, annual nightshades, cudweed, corn spurry, groundsel, purslane, chickweed, mustards and stinkweed. Some activity on annual grasses such as barnyard grass, crab grass, green foxtail, witch grass, annual bluegrass and stink grass. The annual grasses are the first to escape treatment. **Uptake and Translocation:** Absorbed through the roots. Translocated in the transpiration stream to the leaves where it accumulates at the margins. **Basis of Selectivity:** Achieved through differential interception of the herbicide. Metobromuron must be placed on the soil surface and move into the zone of germinating weed seeds but not come in contact with the roots of the germinating crop plants. **Application Methods:** Preemergence. For beans, apply before the beans and weeds emerge; beans should be planted 4–5 cm deep; shallow-planted crops may be injured; do not use on soils with less than 2% organic matter; optimum organic levels are 2%–5%. For potatoes, metobromuron should be applied at ground crack after the first hilling, provided the soil completely covers the emerged potato tips. **Residual Activity:** Relatively short (6–8 weeks). **Unique Characteristics:** Moisture is required for distribution into the top layer of soil where weed seeds are germinating. Soil residues do not carry-over to affect subsequent crop rotations.

METOLACHLOR

See S-METOLACHLOR

METOLACHLOR/ATRAZINE
SEE S-METOLACHLOR/ATRAZINE

METRIBUZIN
Trade Names: CONQUEST A (Available only in CONQUEST co-pack), LEXONE DF, SENCOR 500 F, SENCOR 75 DF, SENCOR SOLUPAK. **Chemical Family:** S-triazine. **Crop and/or Non-Crop Registrations:** Established asparagus, faba beans, potatoes, soybeans, transplant tomatoes, apples, apricots, peaches, cherries, corn and triazine-tolerant canola with trifluralin or with terbacil or with metolachlor on apples, apricots, cherries, plums, peaches and pears. **Sensitive Weeds:** Lamb's-quarters, wild mustard, redroot pigweed, common ragweed, shepherd's-purse, lady's-thumb, velvetleaf, jimsonweed, prostrate pigweed, Russian thistle, yellow wood-sorrel, prickly mallow, chickweed, cocklebur, carpetweed, dandelion seedlings, barnyard grass, crab grass, foxtail, fall panicum, witch grass, Johnson grass seedlings and cheat grass. **Uptake and Translocation:** Some uptake through the foliage but the major route is via the roots. Translocation upwards in the xylem. **Basis of Selectivity:** Degradation by tolerant species. **Application Methods:** Preplant incorporated (potatoes, soybeans, apples, apricots, peaches, cherries, corn, tomatoes and triazine-tolerant canola); preemergence (asparagus, potatoes, soybeans and triazine-tolerant canola); postemergence (potatoes, tomatoes, corn and triazine-tolerant canola). **Residual Activity:** Varies with the climate. At normal-use rates the half-life is 1–2 months. **Unique Characteristics:** Heavy rainfall following application may cause crop damage. Some varieties of potato, soybean and tomato are less tolerant than others. Triazine-resistant weeds are not controlled. Do not use on muck soils.

MINERAL OIL (HERBICIDAL)
Trade Name: AGRICULTURAL WEED KILLER NO. 1. **Chemical Family:** Aliphatic and aromatic hydrocarbons. **Crop and/or Non-Crop Registrations:** Carrot, celery, dill, parsley, parsnips. **Sensitive Weeds:** Annual weeds with the exception of ragweed, wormweed and wild carrot. **Uptake and Translocation:** Absorbed by foliage. Little or no translocation. **Basis of Selectivity:** Low-interception species such as the Umbelliferae family are tolerant. **Application Methods:** Postemergence; broadcast or banded. For carrots, dill, parsley and parsnips, apply as soon as true leaves develop and before roots are thicker than a pencil. For celery, apply as soon as true leaves develop. Weeds should be less than 10 cm tall. Best results will be obtained if spray is applied on cool sunny mornings; do not apply when excessively hot. **Residual Activity:** None. **Unique Characteristics:** Do not apply within 30 days of harvest as late application may flavour the harvested crop.

MINERAL OIL
(NON-HERBICIDAL) (see KORNOIL)

MINERAL OIL/SURFACTANT (NON-HERBICIDAL)
(See ASSIST OIL CONCENTRATE, CHARGE OIL CONCENTRATE, KORNOIL CONCENTRATE XA OIL CONCENTRATE)

MONOLINURON
Trade Name: AFESIN. **Chemical Family:** Substituted urea. **Crop and/or Non-Crop Registrations:** Soybeans, white beans, yellow eye beans, kidney beans, lima beans, snapbeans, potatoes. **Sensitive Weeds:** Particularly effective on most annual broadleaf weeds including triazine-resistant biotypes. Some activity on annual grasses but these will be the first to escape. Cultivation may be required. **Uptake and Translocation:** Uptake is primarily through the roots of germinating weed seedlings, although leaf uptake is possible. Translocated upwards in the xylem to the shoots. **Basis of Selectivity:** Monolinuron is placed on the soil surface and moves down into the zone of germinating weed seeds but not deep enough to come in contact with the roots of germinating crop plants. **Application Methods:** Preemergence. For beans, apply before the beans and weeds emerge; beans should be planted 4–5 cm deep; shallow-planted crops may be injured; do not use on soils with less than 3% organic matter. On potatoes, apply preemergence or when plants are covered by hilling. **Residual Activity:** Relatively short, 4–6 weeks. **Unique Characteristics:** Moisture is required for distribution into the top layer of soil where weed seeds are germinating.

NALCO-TROL
Type of Adjuvant: Drift-control agent. **Chemical Composition:** Polyvinyl polymer. **Registered Uses:** For use with 2,4-D ester or amine, picloram, paraquat, simazine or dicamba for weed or brush control in non-crop land. **Benefit:** Reduces drift, improves canopy penetration and foliage coverage. **Mode of Action:** Reduces spray break-up and thus the number of fine, driftable droplets. **Mixing:** Use 3–1000 mL/1000 L, depending on pressure, height and nozzle type. Add water and, while agitating, add NALCO-TROL before adding liquid herbicides. Add wettable-powder herbicides to water and ensure dispersion before adding NALCO-TROL. **Unique Char-acteristics:** Product is extremely slippery; care should be taken when working on spray equipment and following a spill.

NAPROPAMIDE
Trade Names: DEVRINOL 50 DF, DEVRINOL 50W, DEVRINOL 10G. **Chemical Family:** Amide. **Crop and/or Non-Crop Registrations:** Asparagus, cole crops (cabbage, broccoli, cauliflower, Chinese broccoli, Chinese mustard greens, Chinese Nappa cabbage, Chinese radish), garlic, kohlrabi, peppers, pumpkin, squash, fuzzy squash, rutabagas, tomatoes, tobacco, raspberries, blackberries, cultivated lowbush blueberries, established highbush blueberries, boysenberries, cranberries, loganberries, newly planted or established strawberries, apples, grapes, peaches and pears, newly transplanted or established

ornamentals, woody nursery stock, forest tree stock and container-grown ornamentals (see label for species). With simazine or with terbacil on new plantings of apples, apricots, cherries, plums, peaches and pears. **Sensitive Weeds:** Many annual weeds including crab grass, barnyard grass, annual bluegrass, foxtails, sandbur, wild oats, goose grass, chickweed, groundsel, redroot pigweed, lamb's-quarters, purslane, prostrate knotweed, pineappleweed and prickly lettuce. **Uptake and Translocation:** Absorbed through the roots of germinating weeds. Translocated upward through seedling. **Basis of Selectivity:** Metabolized by tolerant species. Root growth of germinating seedlings is inhibited. Established plants are not affected due to placement selectivity. **Application Methods:** May be applied preplant incorporated using water as the carrier. Incorporation should be uniform, and to a chemical depth of 2.5–5 cm, using irrigation or proper incorporation equipment (e.g., tandem discs or field cultivator with sweep teeth) followed by a levelling device. On established crops, apply to a weed-free soil surface and irrigate in if no rainfall occurs within 7 days after application in spring or fall, or within 2 days after application in summer; irrigate with sufficient water to wet the soil to a depth of 5–10 cm (approximately 7 mm of rain). For post-plant application in tobacco, apply in 25 cm band over the row. Cross-disc or cross-plough after harvest to dilute soil residue before planting cover crop. **Residual Activity:** Provides season-long weed control if properly incorporated. Deep ploughing will minimize any carryover effect. **Unique Characteristics:** Will not control germinated weeds. Resists leaching. To avoid injury to crops not registered for use with napropamide, do not plant until 12 months after the last napropamide application.

NAPTALAM

Trade Name: ALANAP. **Chemical Family:** Amide. **Crop and/or Non-Crop Registrations:** Cucumbers, melons, squash and pumpkins. **Sensitive Weeds:** Seedlings of bindweed, chickweed, cocklebur, lamb's-quarters, pigweed, purslane, ragweed, velvetleaf, crab grass and foxtail. **Uptake and Translocation:** Inhibits seed germination and may be absorbed through the root system after germination. **Application Methods:** Preemergence. Soil clods should be thoroughly broken up and pulverized to give a smooth surface before spray applicaton. Apply up to 48 hours after planting. Following applications, the soil should not be disturbed unless later weed growth makes cultivation necessary. A second application may be applied to cucumbers and melons about 1 month after the first spray, when the crop has emerged but before the weeds are up. Use lower rates on light soil, higher rates on heavy soil. **Residual Activity:** Completely decomposes in 6–8 weeks. **Unique Characteristics:** Do not apply during very wet, cold weather as stunting of the crop may result. Avoid spray drift to areas planted to sensitive crops such as beets, tomatoes and spinach.

NICOSULFURON

Trade Name: ACCENT. **Chemical Family:** Sulfonylurea. **Crop and/or Non-Crop Registrations:** Field corn, certain varieties only of sweet corn. Not for use on seed corn. **Sensitive Weeds:** Quack grass, proso millet, green and yellow foxtail, fall panicum, barnyard grass, old witch grass. **Uptake and Translocation:** Following foliar absorption, nicosulfuron is rapidly absorbed through the leaves and translocated in both xylem and phloem. **Basis of Selectivity:** Inhibition of acetolactate synthase (ALS) enzyme in susceptible plants leads to a rapid cessation of cell division and regrowth. Tolerant species rapidly convert nicosulfuron to non-phytotoxic metabolites. **Application Method**: Postemergent within the 1- to 8-leaf stage of corn. **Residual Activity:** No soil residual activity. **Unique Characteristics:** Emerged grasses will be controlled by nicosulfuron but subsequent germinating grasses will not be controlled. A non-ionic surfactant must be added at 0.2% v/v. Typical symptoms of plant death (chlorosis, necrosis) occur 5–10 days after application, depending on growing conditions. Do not apply to corn that has been treated with an organophosphorus soil insecticide (i.e., COUNTER, LORSBAN, THIMET, CYGARD or DI-SYSTON).

NICOSULFURON/RIMSULFURON

Trade Name: ULTIM. **Chemical Family:** Sulfonylurea/Sulfonylurea. **Crop and/or Non-Crop Registrations:** Field corn. Not for use on sweet or seed corn. **Sensitive Weeds:** Quack grass, proso millet, green and yellow foxtail, fall panicum, barnyard grass, witch grass, redroot pigweed (incl. triazine-resistant). **Uptake and Translocation:** Following foliar application, nicosulfuron/rimsulfuron rapidly absorbed through the leaves and translocated in both xylem and phloem. **Basis of Selectivity:** Inhibition of acetolactate synthase (ALS) enzyme in susceptible plants leads to a rapid cessation of cell division and growth. Tolerant species rapidly convert nicosulfuron/rimsulfuron to non-phytotoxic metabolites. **Application Method:** Postemergent, within the 1- to 6-leaf stage of corn. **Residual Activity:** Rapid soil microbial degradation. **Unique Characteristics:** Emerged grasses will be controlled by nicosulfuron/rimsulfuron, but subsequent germinating grass weeds will not be controlled. A non-ionic surfactant must be added at 0.2% v/v. Typical symptoms of plant death (chlorosis, necrosis) occur 5–10 days after application, depending on growing conditions. Tank mix with cyanazine, bromoxynil or dicamba for control of broadleaf weeds. Do not apply to corn that has been treated with an organophosphorous soil insecticide (i.e., COUNTER, LORSBAN, THIMET, CYGARD or DI-SYSTON). Do not use on corn hybrids with a crop heat unit (CHU) rating of 2500 or less, or in geographic regions with 2500 or less average seasonal CHU. Nicosulfuron/ rimsulfuron should not be sprayed for weed control in fields planted with some hybrids. SEE THE LABEL FOR LIST.

NB: Trade names and common names of herbicides are cross-referenced in Table 1.

NICOSULFURON/RIMSULFURON+ FLUMETSULAM/CHLOPYRALID/2,4-D

Trade Name: ULTIMAX (co-pack of ULTIM+MAX). **Chemical Family:** Sulfonylurea + Triazolopyrimidine sulfonanilide/Pyridine/Phenoxy. **Crop and/or Non-Crop Registrations:** Field corn. **Sensitive Weeds:** Quack grass, proso millet, green and yellow foxtail, fall panicum, barnyard grass, witch grass, redroot pigweed, common ragweed, velvetleaf, common chickweed, lady's thumb. **Uptake and Translocation:** Rapidly absorbed through the leaves and translocated in both xylem and phloem. **Basis of Selectivity:** Selectivity of nicosulfuron, rimsulfuron, and flumetsulam is based on metabolism. Basis of selectivity of clopyralid and 2,4-D is not known. **Application Method:** Postemergent, up to the 6-leaf stage of corn. **Residual Activity:** If adequate rainfall is received following application, ULTIMAX will provide some residual control of late germinating annual broadleaf and grass weeds. **Unique Characteristics:** Typical symptoms of plant death (chlorosis, necrosis) occur 5–10 days after application, depending on growing conditions. Favourable growing conditions will speed the activity while cool or dry conditions will delay activity. Do not apply to corn that has been treated with an organophosphorous soil insecticide (i.e., COUNTER, LORSBAN, THIMET, CYGARD or DI-SYSTON). Do not apply beyond the 6-leaf stage of corn as serious crop injury may result. Do not use on corn hybrids with a crop heat unit (CHU) rating of 2500 or less, or in geographic regions with 2500 or less average seasonal CHU. ULTIMAX should not be sprayed on certain sensitive hybrids. READ THE LABEL FOR COMPLETE LIST.

OIL

(See MINERAL OIL).

OXADIAZON

Trade Name: RONSTAR 2G. **Chemical Family:** Oxadiazole. **Crop and/or Non-Crop Registrations:** Woody ornamental shrubs, vines and trees grown in containers. **Sensitive Weeds:** Annual weeds including stinkweed, bittercress, common groundsel, lamb's-quarters, purslane, black nightshade, pigweeds, redroot, tumble, shepherd's-purse, annual bluegrass, barnyard grass, green and yellow foxtails and crab grass. **Uptake and Translocation:** Primarily taken up through emerging shoots when they penetrate through the treated soil layer. **Basis of Selectivity:** Greater physiological tolerance relative to susceptible species and lack of contact with sensitive crop tissue. **Application Method:** Applications may be made to both newly transplanted and established ornamentals preemergent to weed germination. Existing weed growth must be removed for satisfactory weed control. **Residual Activity:** 60–120 days **Unique Characteristics:** When applied to soil, the material is rapidly and strongly fixed by soil colloids. Due to its low water solubility and to this adsorption, the downward and lateral movement is limited under the influence of rain or irrigation. Therefore, the chemical must be applied uniformly for satisfactory weed control. Moisture is required to activate the chemical. Rainfall or overhead irrigation after application will improve weed control.

OXYFLUORFEN

Trade Name: GOAL. **Chemical Family:** Diphenyl ether. **Crop and/or Non-Crop Registrations:** Onions. **Sensitive Weeds:** Purslane, pigweed, annual nightshades, wild buckwheat, lamb's-quarters. **Uptake and Translocation:** Primarily foliar absorption but some root absorption. Very little movement within the plant following foliar or root absorption. **Application Methods:** Postemergence. Best control is obtained when weeds are in the 2- to 4-leaf stage and actively growing. The first application can be made when onions have 2 fully developed true leaves. Repeat applications may be necessary to control late-germinating weeds. Use at least 500 L of water/ha. **Residual Activity:** Limited preemergence activity. **Unique Char acteristics:** Use on dry bulb onions. Do not use when crop or weeds are under stress. Do not apply within 56 days prior to harvest.

PARAQUAT

Trade Name: GRAMOXONE. **Chemical Family:** Bipyridylium. **Crop and/or Non-Crop Registrations:** Apples, apricots, cherries, currants, gooseberries, grapes, highbush blueberries, peaches, pears and plums established more than 1 year; blackberries, loganberries and red raspberries; inter-row spraying in strawberries; stale seedbed technique for vegetables and field crops; inter-row directed chemical weeding for vegetable fields and established nursery crops; asparagus; potatoes; established alfalfa and bird's-foot trefoil; pasture renovation; zero tillage corn; conifer control; turf renovation; chemical mowing weed control in non-crop land; aquatic weed control. **Sensitive Weeds:** Non-selective — affects all green plants. **Uptake and Translocation:** Absorbed by foliage and green bark; little or no translocation. **Basis of Selectivity:** All green plant tissue is sensitive. Less effective on plants with a very waxy cuticle and linear leaf shape such as nut sedge. Safe on mature (non-green) bark of woody plants. **Application Methods:** Postemergence. Broadcast, or directed spray to avoid contacting leaves or bark of desirable plants. Apply when weeds are less than 15 cm high. Better results are usually obtained if application is made on a dull or cloudy day, or in the evening. **Residual Activity:** Essentially no residual activity in soil. Will persist in organic material such as mulches or turf thatch; therefore, do not reseed these areas for 5 days. More than one application per season may be necessary, especially for perennial weeds. **Unique Characteristics:** Inactivated by adsorption to soil particles. Not available to homowners. For a domestic registration, see paraquat/diquat.

PARAQUAT/DIQUAT

Trade Names: WEED AND GRASS KILLER, WEED-BAN. **Chemical Family:** Bipyridylium/bipyridylium. **Crop and/or Non-Crop Registrations:** "Chemical mower" to control weeds on driveways, pathways and other non-cultivated areas. **Sensitive Weeds:** All green plant tissue. Less effective on plants with a thick, waxy cuticle such as nut sedge. **Uptake and Translocation:** Foliar contact activity. Little or no translocation. **Basis of Selectivity:** No selectivity for green plants. Will not penetrate the mature (non-green) bark of woody plants. **Application Method:** Postemergence. **Residual Activity:** Essentially none; inactivated by adsorption to soil particles. May remain active in turf thatch after application, therefore, thorough cultivation of a turf area is required before seeding. **Unique Characteristics:** Best results follow application on dull or cloudy days, or in the evening.

PENDIMETHALIN

Trade Name: PROWL. **Chemical Family:** Dinitroaniline. **Crop and/or Non-crop Registrations:** Onions and field corn. **Sensitive Weeds:** Green foxtail, yellow foxtail, crab grass, barnyard grass, fall panicum, common chickweed, lamb's-quarters and pigweed. **Uptake and Translocation:** Weeds are controlled as they germinate. Translocation is not significant and emerged weeds are not controlled. **Basis of Selectivity:** No significant uptake or translocation by the crop. **Application Methods:** Onions: postemergence to the crop at loop and 2-leaf stage. Field corn: preemergence and early postemergence. For preemergence application, pendimethalin may be applied in water or liquid fertilizer. A fertilizer compatibility test should be carried out using pendimethalin and any of its registered tank mix partners. Early postemergence application may only use water as a carrier. **Residual Activity:** Persistence depends on weather conditions (more persistent under dry conditions). Only registered crops may be planted in the year of application. Soybeans and corn may be planted the year following application in corn. Days to harvest restriction: 100 days. **Unique Characteristics:** Strongly adsorbed to soil particles. Most effective when rain is received within 7 days of application. For onions, application at both growth stages is required for season-long control. Tank mixes in corn or sequential application of other herbicides in onions and corn are required for broad-spectrum weed control. Registered for dry bulb onions grown on muck soil only. DO NOT graze treated fields or feed treated foliage to livestock prior to 100 days after PROWL application.

PHENMEDIPHAM

Trade Name: SPIN-AID. **Chemical Family:** Phenylcarbamate. **Crop and/or Non-Crop Registrations:** Red (table) beets. **Sensitive Weeds:** Lamb's-quarters, wild buckwheat, green foxtail, yellow foxtail, mustard. **Uptake and Translocation:** Phenmedipham is absorbed by the leaves where it acts by inhibiting the Hill reaction in the chloroplasts of leaf cells. **Application Method:** Postemergence. **Residual Activity:** Half-life of phenmedipham is approximately 25 days. **Unique Characteristics:** Phenmedipham may injure beets that are under stress. It may cause temporary growth retardation and/or chlorosis or tip-burn on red beets. Beets usually resume normal growth within 10 days.

PICLORAM/2,4-D

Trade Name: TORDON 101 MIXTURE. **Chemical Family:** Pyridine/phenoxy. **Crop and/or Non-Crop Registrations:** Weed and brush (including conifer) control in non-crop locations, industrial sites and rights-of-way. **Sensitive Weeds:** Most broadleaf herbaceous weeds including Canada thistle, sweet and red clover, wild carrot, common ragweed, dandelion, goldenrod, dock, plantain, prickly lettuce, burdock, fleabane and vetch; deciduous and coniferous woody plants except white ash. **Uptake and Translocation:** Rapidly absorbed by the roots, stems and foliage. Translocation can be up or down but, like 2,4-D, accumulation is in young, rapidly growing meristematic tissue. **Basis of Selectivity:** Effects on nucleic acid metabolism and growth are not observed in grasses and other tolerant species. **Application Methods:** For deciduous and coniferous brush, apply either broadcast using a fixed nozzle (constant volume per hectare) or selectively using a spray gun (variable volume per hectare). As spray gun applications use a more dilute spray mix, this type of application must thoroughly wet the foliage, stem and root collar. Brush should be treated after foliage is well developed in spring or early summer. To ensure thorough coverage and minimize drift, brush to be treated should be less than 2.5 m tall. For cut-surface treatment, mix with water or ethylene glycol (to reduce the freezing point, if necessary) and apply to cover the cambium layer of freshly cut stumps. For broadleaf herbaceous weeds, apply broadcast in spring or early summer after growth begins. **Residual Activity:** Soil residue carryover into the year following application is minimal when applied at recommended rates. Degradation is most rapid under warm, humid conditions. Because small residues of picloram in soil can be phytotoxic to crops such as soybeans, tobacco, tomatoes, potatoes, grapes and many desirable ornamental plants, picloram may not be applied to land used, or land that may be used, for the production of agricultural and horticultural crops. **Unique Characteristics:** A permit from the Ministry of the Environment is required for the purchase and use of picloram/2,4-D in Ontario. Picloram/2,4-D must not be applied over, or near, areas where roots of desirable trees or other plants may extend. Because spray drift is phytotoxic to sensitive plants, an approved drift-control system or additive is recommended when making low-volume applications adjacent to desirable trees or crops.

PROMETRYNE

Trade Name: GESAGARD **Chemical Family:** S-triazine. **Crop and/or Non-Crop Registrations:** Carrots, peas, leeks, and transplanted celery.

NB: Trade names and common names of herbicides are cross-referenced in Table 1.

Sensitive Weeds: Lamb's-quarters, lady's-thumb, corn spurry, pigweed, wild mustard, purslane, eastern black nightshade, chickweed, hemp-nettle and green foxtail. **Uptake and Translocation:** Absorbed through foliage and roots. Translocated upwards through xylem, accumulating in the apical meristems. **Basis of Selectivity:** Metabolized by tolerant plants and to a lesser extent by sensitive plants, although this is not thought to be the major selective mechanism. **Application Methods:** Preemergence or early postemergence (before weeds are 5 cm high). Apply before carrots or peas emerge. Apply 7–14 days after celery is transplanted. **Residual Activity:** About 6–8 weeks. A fall cover crop of rye or oats may be sown on the treated land in the same season.

PROPANIL/MCPA

Trade Name: STAMPEDE CM. **Chemical Family:** Acetanilide/phenoxy. **Crop and/or Non-Crop Registrations:** Spring wheat, barley and oats. **Sensitive Weeds:** Green and yellow foxtail; certain broadleaf weeds such as wild buckwheat, lady's-thumb and pale smartweed. **Uptake and Translocation:** Propanil is absorbed by leaves; translocated to growing point of shoot and then back to other leaves. MCPA is absorbed by leaves; translocated to growing points of shoot and root. **Basis of Selectivity:** Faster metabolism of herbicide by tolerant species. **Application Methods:** Postemergence. Best control is obtained when weeds are small and actively growing, relative humidity is high and daily maximum temperature exceeds 21°C. Apply when cereals are in the 2- to 5-leaf stage and weeds are in the 1- to 4-leaf stage. Do not apply if daily maximum temperature is not expected to exceed 10°C or if frost is expected within 24 hours. Thorough spray coverage is necessary. **Residual Activity:** None. **Unique Characteristics:** May cause crop yellowing or tip burn but these effects are temporary and normally disappear in 10–14 days.

PROPYZAMIDE

Trade Name: KERB. **Chemical Family:** Amide. **Crop and/or Non-Crop Registrations:** Alfalfa, bird's-foot trefoil, woody nursery stock, lettuce, apples, pears, lowbush blueberries. **Sensitive Weeds:** Perennial grasses including quack grass, annual grasses, volunteer cereals and common chickweed. **Uptake and Translocation:** Taken up by plant roots and translocated to the foliage. Little foliar absorption. **Basis of Selectivity:** Faster degradation in tolerant species. **Application Methods:** Preemergence to annual weeds. Postemergence control of perennial grasses when applied in the fall. Apply in the fall from late September to early November when the soil temperature is low but above freezing, and soil moisture is high. **Residual Activity:** Persistence is variable (2–9 months), depending on soil type and climatic conditions. Decomposition of the herbicide is slow at temperatures below 15°C but accelerates at temperatures above this level. Persistence is greatest in sandy soils with low organic matter. **Unique Characteristics:** Rainfall or irrigation is required after application to move the herbicide into the root zone for uptake by perennial grasses and germinating annual grasses.

PROSULFURON

Trade Name: PEAK. (Available only in PEAKPLUS co-pack)

PROSULFURON/DICAMBA

Trade Name: PEAKPLUS (co-pack of PEAK+BANVEL II). **Chemical Family:** Sulfonyl urea+benzoic acid.. **Crop and/or Non-Crop Registrations:** Field corn. **Sensitive Weeds:** Lamb's-quarters (including triazine tolerant), redroot pigweed, cocklebur, lady's thumb, wild mustard, velvetleaf, common ragweed. **Uptake and Translocation:** Following foliar application and uptake, prosulfuron is translocated through phloem to meristematic tissues. Growth of susceptible species ceases rapidly, followed by discolouration of leaves; death takes one to three weeks to occur. **Basis of Selectivity:** Inhibition of the enzyme acetolactate synthase. Tolerant species rapidly metabolize prosulfuron. **Application Methods:** Postemergent, within the 2 to 7 leaf stages of corn. **Residual Activity:** Degradation primarily by soil microbial action. Prosulfuron will provide a sufficient degree of control of later germinating broadleaf weeds. Approved rotational crops are soybeans, dry beans, peas, cerelas, and corn. See the label and Table 5 for rotational restrictions **Unique Characteristics:** Prosulfuron must be applied in a tank mix combination with a reduced rate of dicamba. Refer to the corn recommendation section for products and rates. An adjuvant must be added at 0.2% v/v. Do not apply to corn treated with a granular organophosphate insecticide.

PYRAZON

Trade Name: PYRAMIN FL. **Chemical Family:** Pyridazinone. **Crop and/or Non-Crop Registrations:** Sugar beets and table beets. With NORTRON on sugar beets. **Sensitive Weeds:** Annual nightshades, chickweed, knotweed, lady's-thumb, lamb's-quarters, oak-leaved goosefoot, prostrate pigweed, purslane, ragweed, redroot pigweed, shepherd's-purse, smartweed, stinkweed, wild buckwheat, wild carrot (seedling), wild mustard, wormseed mustard and yellow rocket (seedling). **Uptake and Translocation:** Can be taken up by both roots and leaves, but translocation is upward to leaves where it inhibits photosynthesis. **Basis of Selectivity:** Metabolism by tolerant species. **Application Methods:** Preplant incorporated, preemergence, or postemergence after the second true-leaf stage of the beets. **Residual Activity:** Average persistence is about 4–8 weeks in soil, depending on soil moisture and temperature. Residue carryover problems are unlikely. **Unique Characteristics:** With preemergence applications, at least 1.25 cm of rainfall is required for good weed control. Combinations of pyrazon and TCA are most useful where both annual broadleaf weeds and grasses are a problem. These treatments may not be effective on high organic soils or dry soils (i.e., muck soils or with

late planted beets when soils are drier). Under these circumstances, postemergence applications of pyrazon plus TCA as a band over the row may be most effective. However, to be selective and effective the chemicals must be applied after the cotyledons of the beets are 2.5 cm long and before the weeds have reached the 4 true-leaf stage (10 cm). Where TCA has been used, beet tops should not be fed to livestock. TCA residues in the soil can be a problem for some crops such as corn.

PYRIDATE

Trade Name: LENTAGRAN. **Chemical Family:** Phenyl pyridazine. **Crop and/or Non-Crop Registrations:** Cabbage, corn (field, sweet, seed), tomato. **Sensitive Weeds:** Annual broadleaf weeds (1- to 4-leaf stage) including triazine-resistant species, certain annual grasses (1- to 3-leaf stage) when the weeds are actively growing. Pyridate alone: lamb's-quarters and redroot pigweed. For Pyridate plus atrazine on corn and for pyridate plus metribuzin on tomatoes: lamb's-quarters, redroot pigweed, nightshade, purslane, ragweed (common), wild mustard, velvetleaf and suppression of buckwheat (wild), lady's-thumb (smartweed), barnyard grass, crab grass (hairy), foxtail (green and yellow). Where heavy annual grass pressure is a problem, use a specific preemergence grass herbicide. **Uptake and Translocation:** Rapidly absorbed by leaves and acts as a contact only. **Basis of Selectivity:** It penetrates into both sensitive and tolerant plants but is quickly metabolized and inactivated in tolerant crops such as corn,. In sensitive weeds, activity is evident by marginal yellowing, followed by yellowing and browning of the entire leaf. This visible evidence generally occurs within 4–7 days after application. Activity is more rapid at higher temperatures and under good growing conditions. Weed control under drought conditions may be decreased. **Application Method:** Postemergence. Sprays can be applied overall on corn and directed on transplanted tomatoes. **Residual Activity:** None. **Unique Characteristics:** Combination with triazine herbicides improves total weed control. The stage of the weed, not the stage of the corn, determines application date. Tomatoes will show temporary yellowing, which is reduced by directing the spray to the bottom one-third of well-established tomato plants. Uptake by leaves is very rapid and rainfall shortly after application (1–2 hours) has little effect on the degree of control.

QUIZALOFOP-P-ETHYL

Trade Name: ASSURE II. **Chemical Family:** Aryloxyphenoxypropionate. **Crop and/or Non-Crop Registrations:** Soybeans, flax, canola, seed alfalfa and sugar beets. **Sensitive Weeds:** Green foxtail, barnyard grass, fall panicum, old witch grass, proso millet, wild oats, volunteer cereals and volunteer corn. **Uptake And Translocation:** Rapidly absorbed and readily translocated in both the xylem and phloem from the treated foliage to the root system and growing points of the plant. **Basis Of Selectivity:** Disruption of fatty acid biosynthesis leading to increased permeability and cellular disruption in sensitive plants. Rapid metabolism of the active herbicide in tolerant species. **Application Methods:** Postemergence. **Residual Activity:** Rapid microbial degradation and essentially no soil activity. **Unique Characteristics:** Apply with CANPLUS-411 at 5-10 litres per 1000 litres of spray solution or SURE-MIX at 5 litres per 1000 litres of spray solution. Tank-mix with PINNACLE or PINNACLE + BASAGRAN FORTE for control of broadleaf weeds.

RIMSULFURON

Trade Name: ELIM EP, PRISM. **Chemical Family:** Sulfonylurea. **Crop and/or Non-Crop Registrations:** ELIM EP - Field corn. Not for use on sweet or seed corn. PRISM - Potatoes, transplanted processing tomatoes. Not for use on potatoes grown for seed. **Sensitive Weeds:** Green foxtail, fall panicum. barnyard grass, redroot pigweed (incl. triazine-resistant), hairy nightshade, Suppression of yellow foxtail, witch grass, lamb's-quarters. **Uptake and Translocation:** Following foliar application, rimsulfuron is rapidly absorbed through the leaves and translocated in both xylem and phloem. **Basis of Selectivity:** Inhibition of acetolactate synthase (ALS) enzyme in susceptible plants leads to a rapid cessation of cell division and growth. Tolerant species rapidly convert rimsulfuron to non-phytotoxic metobolites. **Application Method:** Postemergent, within the spike-3-leaf stage of corn. Prior to initiation of flowering in potatoes. **Residual Activity:** Rapid soil microbial degradation. **Unique Characteristics:** Emerged grasses will be controlled by rimsulfuron, but subsequent germinating grass weeds will not be controlled. A non-ionic surfactant must be added at 0.2%v/v. Typical symptoms of plant death (chlorosis, necrosis) occur 5–10 days after application, depending on growing conditions. Tank mix with dicamba for control of broadleaf weeds in corn. Do not apply rimsulfuron to corn that has been treated with an organophosphorous soil insecticide (i.e., COUNTER, LORSBAN, THIMET, CYGARD or DI-SYSTON). Do not use rimsulfuron on corn hybrids with a Crop Heat Unit (CHU) rating of 2500 or less, or in geographic regions with 2500 or less average seasonal CHU. Rimsulfuron should not be sprayed for weed control in fields planted with some hybrids. SEE THE LABEL FOR LIST.

S-METOLACHLOR

Trade Names: DUAL MAGNUM, DUAL II MAGNUM. **Chemical Family:** Acetanilide. **Crop and/or Non-Crop Registrations:** Corn, soybeans, snap beans (yellow and green only), dry beans (white, kidney and pinto only), lima beans, transplanted cole crops (cabbage, cauliflower, broccoli), transplanted tomatoes, potatoes, sugar beets, processing peas, rutabagas and sweet white lupins, apples, apricots, cherries, peaches, pears and plums. **Sensitive Weeds:** Large and smooth crab grass; witch grass; barnyard grass; fall panicum; giant, green and yellow foxtail; yellow nut sedge; American nightshade, eastern black nightshade. **Uptake and Translocation:** Absorbed by germinating grasses

mainly through shoot just above seed. Absorbed by germinating broadleaf weeds through roots and shoots. **Basis of Selectivity:** Metabolized by tolerant species. **Application Methods:** Early preplant, preplant incorporated and preemergence. Early postemergence on corn (spike to 2-leaf stage of corn). Incorporation equipment should be set to work the soil 10 cm deep with a disc operating at 6–10 km/hr or a vibrating shank cultivator at 10–13 km/hr; one incorporation is sufficient and need not be immediate. Rainfall within 10 days is required for maximum activity of the preemergence application. **Residual Activity:** Activity will normally be maintained for 10–14 weeks. **Unique Characteristics:** The rate required depends on weed pressure (higher rate for heavier weed pressure). Yellow nut sedge control requires a preplant incorporated application. Winter cereals may be planted 4–5 months after metolachlor application. Many tank mix combinations are registered on various crops. Do not use on muck soils or coarse-textured soils low in organic matter. DUAL II MAGNUM contains benoxacor, a chemical that enhances the corn plant's ability to metabolize s-metolachlor, thereby preventing corn injury even under adverse environmental conditions.

S-METOLACHLOR/ATRAZINE

Trade Name: PRIMEXTRA II MAGNUM. **Chemical Family:** Acetanilide/s-triazine. **Crop and/or Non-Crop Registrations:** Corn (ensilage, field, seed and sweet). **Sensitive Weeds:** Germinating annual broadleaf weeds and annual grasses such as Amercian nightshade, eastern black nightshade, lady's-thumb, lamb's-quarters, wild mustard, purslane, prostrate pigweed, redroot pigweed, wild buckwheat, smartweed, ragweed, crab grass, barnyard grass, green foxtail, yellow foxtail, giant foxtail, witch grass and fall panicum. Yellow nut sedge can be controlled with a preplant incorporated application. **Uptake and Translocation:** Absorbed by germinating grasses mainly through shoot just above seed. Absorbed by germinating broadleaf weeds through roots and shoot. **Basis of Selectivity:** Metabolized by tolerant species. **Application Methods:** Early preplant, preplant incorporated, and preemergence. Early postemergence on corn (spike to 2 leaf stage of corn. Incorporation equipment should be set to work the soil 10 cm deep with a disc operating at 6–10 km/hr or a vibrating shank cultivator at 10–13 km/hr.). One incorporation is sufficient and need not be immediate. Rainfall within 10 days is required for maximum activity of the preemergence application. S-metolachlor/atrazine may be applied in nitrogen solutions or liquid fertilizers for preplant incorporated or preemergence weed control. Dry bulk granular fertilizers may be impregnated with metolachlor/atrazine for preplant incorporation. **Residual Activity:** Activity will normally be maintained for 10–14 weeks; late-germinating fall panicum will not be controlled. Soybeans, white beans, oats or barley may be planted the following spring. **Unique Characteristics:** The rate required depends on weed pressure (higher rate for heavier weed pressure. Yellow nut sedge control requires a preplant incorporated application. Will not control triazine-resistant weed species. Contains atrazine in low amounts, which may carry over in a dry year. Is effective over a wide range of soil types and has a good margin of crop safety. Perennial weeds are not controlled. Primextra II MAGNUM contains benoxacor, a chemical that enhances the corn plant's ability to metabolize s-metolachlor, thereby preventing corn injury even under adverse environmental conditions.

SETHOXYDIM

TRADE NAME: POAST ULTRA. **Chemical Family:** Cyclohexanedione. **Crop and/or Non-Crop Registrations:** Canola (rapeseed), flax, soybeans, dry beans, snap beans, peas, onions, tomatoes, potatoes, sweet potato, pumpkin, squash, cucumbers, alfalfa, lima beans, faba beans, adzuki beans, mung beans, buckwheat, creeping red fescue, garlic, broccoli, cabbage, cauliflower, peppermint, spearmint, apples, apricots, cherries, peaches, pears, plums, highbush blueberries, cranberries and sethoxydim-resistant corn. **Sensitive Weeds:** Annual grasses (wild oats, foxtails, barnyard grass, large crab grass, proso millet, fall panicum and witch grass), volunteer corn and cereals and quack grass. **Uptake and Translocation:** Absorbed by foliage. Translocated upwards and downwards in plant. **Basis of Selectivity:** Degraded by tolerant species (broadleaf plants). **Application Methods:** Postemergence to actively growing annual grasses in the 1- to 6-leaf stage and quack grass in the 1- to 3-leaf stage. Use flat fan nozzles and add MERGE adjuvant to the spray mix. Alternatively, ASSIST OIL CONCENTRATE or Ammonium sulphate plus ASSIST OIL CONCENTRATE may be used. Other postemergence herbicides that are not recommended as tank mix combinations on the label must be applied at least 4 days before or after sethoxydim application. Aerial application is also registered. **Residual Activity:** Essentially none. A second application and/or cultivation may be necessary to control grasses that emerge after treatment. **Unique Characteristics:** Susceptible grasses, when sprayed, stop growing immediately and then gradually turn yellow to purple to brown over a period of 7–21 days, depending on growing conditions and crop competition. Rainfall within 1 hour after application may reduce effectiveness. If treated grasses are stressed (drought, flooding, prolonged cool temperatures) control will be delayed or reduced.

SIDEKICK

Type of Adjuvant: Non-ionic liquid spreader/activator. **Chemical Composition:** Alkylarylpolyoxyethylene glycols, free fatty acids & isopropyl alcohol **Registered Uses:** For use with imazethapyr, metsulfuron-methyl, nicosulfuron, quinalofop-ethyl. **Benefit:** Improves spray chemical effectiveness. **Mode of Action:** It is a wetting and spreading agent that improves coverage of spray mixtures. **Mixing:** Make sure the spray tank is thoroughly cleaned before mixing. Fill the spray tank half full with water. Add the required amount of herbicide as directed by its label with the agitator

running. Ensure that the herbicide is completely mixed before proceeding to the next step. SLOWLY add the SIDEKICK, agitating during the entire process. Continue to agitate while filling the tank with water and agitate before and during each application to insure a uniform spray. **Unique Characteristics:** Do not exceed recommended rates of SIDEKICK, as too much may reduce the effectiveness of the herbicide due to excessive run-off. Consult product label for full directions.

SIMAZINE

Trade Names: PRINCEP NINE-T, SIMADEX, SIMAZINE, SIMAZINE 480. **Chemical Family:** S-triazine. **Crop and/or Non-Crop Registrations:** Corn, established asparagus, bird's-foot trefoil, raspberries, loganberries, blackberries, highbush blueberries, alfalfa, apples, apricots, cherries, peaches, pears and plums established for 1 year or more; grapes established for 3 or more years; shelterbelts established for at least one growing season (caragana, green ash, Siberian elm, American elm and Manitoba maple); new or established Christmas tree and woodland plantations (2 year or older white pine and balsam fir); woody ornamentals and nursery stock established for at least 1 year (cedar, barberry, apple, flowering crab apple, box wood, cotoneaster, dogwood, holly, rose, yews, chamaecyparis, hemlock, juniper, multiflora rose, peony; spruce, mugho pine, black walnut and white ash); nursery container stock (cedar, juniper, yew); aquatic weed control; non-crop land. Conifer site preparation before planting of fir, pine and spruce (Princep Nine-T only). **Sensitive Weeds:** Annual broadleaf weeds such as pigweed, lady's-thumb, lamb's-quarters, purslane, ragweed, volunteer clover, wild buckwheat, smartweed, plantain and groundsel; annual grasses such as barnyard grass, crab grass, wild oats and yellow foxtail (triazine-resistant biotypes of foxtail, lamb's-quarters, pigweed and groundsel will not be controlled); most perennial species starting freshly from seed. **Uptake and Translocation:** Absorbed by roots; little or no foliar absorption; translocated upwards in xylem, accumulating in apical meristem and leaves with napropamide on new plantings of apples, apricot, cherries, plums, peaches and pears. **Basis of Selectivity:** Some species, such as corn, metabolize simazine. In most crops, selectivity is based on the roots of the crop plants being deeper than the depth to which simazine leaches. **Application Methods:** Preplant incorporated (to a depth of 2.5 cm) or preemergence in corn; preemergence in other crops. Broadcast or band application. In fruit crops, apply a 1m wide band under the plants; cultivate or sod the area between the rows. For aquatic weed control, apply as a draw-down treatment or water-volume application in drainage ditches and ponds with no water flow-through. **Residual Activity:** Soil residues may persist for more than 1 season. After spraying with simazine, do not plant any crop in the treated area in the same year except corn. Where rates in excess of 2 kg/ha have been applied, do not plant rotational crops in the following year; soils should be tested if there is any question of excessive residues remaining. **Unique Characteristics:** Needs sufficient moisture to be activated. Should be applied only once per season. To avoid build-up of resistant weeds, simazine should be rotated with other non-triazine residual herbicides. Simazine is more persistant than atrazine. Where rainfall is sufficient to cause erosion, soil containing simazine may wash to lower areas of land and injure existing or subsequent crops.

SPRAY ADJUVANT DEFOAMER

Type of Adjuvant: Defoamer. **Chemical Composition:** Dimethylpolysiloxane. **Registered Uses:** To reduce foaming in spray mixes of atrazine. **Benefit:** Reduces foaming. **Mixing:** To control foam when mixing spray solution, add defoamer either just before or during addition of any other spray adjuvant. To cut existing foam, add defoamer to tank and recirculate solution until foam dissipates. **Unique Characteristics:** Do not use with any other herbicide or herbicide/adjuvant mixture.

SUPER SPREADER STICKER

Type of Adjuvant: Non-ionic spreader sticker surfactant. **Chemical Composition:** Octyl phenoxypoly ethoxy ethanol 50%. **Registered Uses:** For use with ALLY, AMBER, atrazine, BASAGRAN, ethametsulfuron-methyl, thifensulfuron methyl, pyrazon, chlorsulfuron, thifensulfuron-methyl/trifenuron-methyl, nicosulfuron, rimsulfuron/nicosulfuron. **Benefit:** Improves postemergence control of weeds that have reached their upper limit in size for susceptibility. **Mode of Action:** Causes the spray mix to form a continuous film on leaf surfaces; also makes herbicide more rainfast. **Mixing:** Half-fill tank with water; add herbicide with continuous agitation; complete filling of tank with water; add SUPER SPREADER STICKER with continuous agitation. **Unique Characteristics:** Higher rates are required with hard water.

SURE-MIX

Type of Adjuvant: Paraffinic petroleum oil/surfactant (non-herbicidal). **Chemical Composition:** 60% Paraffinic petroleum oil plus 35.6% surfactant blend. **Registered uses:** SURE-MIX is registered for use with ASSURE II. **Benefit:** The use of SURE-MIX results in improved activity of ASSURE II and a greater degree of consistency under varying environmental conditions. **Mode of Action:** Reduces the evaporation of spray droplets from the leaf surface and decreases the surface tension of spray droplets thus improving penetration through the cuticle of leaf surfaces. **Mixing:** Add the required amount of water to the spray tank with agitator running. Add ASSURE II and after well mixed add 5 litres of SURE-MIX for each 1000 litres of spray solution. **Unique characteristics:** May cause some minor leaf speckling under hot and humid weather conditions.

SURFACTANTS

(See AGRAL 90, AG-SURF, COMPANION, CANPLUS 411,CITOWETT PLUS, ENHANCE, LI700, MERGE, SIDEKICK, SYLGARD 309).

NB: Trade names and common names of herbicides are cross-referenced in Table 1.

SYLGARD 309

Type of Adjuvant: Non-ionic surfactant. **Chemical Composition:** Siloxylated polyether 76%. **Registered Uses:** For use with bentazon on soybeans for annual broadleaf weed control; imazethapyr on soybeans for annual broadleaf and grass control; and glyphosate for quack grass control and annual broadleaf weed control in summer fallow; and with picloram/2,4-D for faster burndown of coniferous species on right-of-ways. **Benefits**: Improves chemical effectiveness by increasing the amount and rate of uptake of water-soluble herbicides. **Mixing:** Use 2.5 L/1,000 L of spray solution for most applications; add this amount last to the spray tank after the herbicide has been thoroughly mixed. Apply the spray solution as soon as possible after mixing. **Unique Characteristics:** This organosilicone formulation has lowest surface tension of any adjuvant available.

TERBACIL

Trade Name: SINBAR. **Chemical Family:** Uracil. **Crop and/or Non-Crop Registrations:** apples, apricots, cherries, highbush blueberries, peaches, pears, plums, spearmint, peppermint, and strawberries; with napropamide on new plantings of apples, apricots, cherries, plums, peaches and pears. **Sensitive Weeds:** Barnyard grass, bluegrass, crab grass, foxtail, chickweed, cheat grass, perennial rye grass, wild barley, mustard, prickly lettuce, stinkweed, annual sow-thistle, henbit, lamb's-quarters, pigweed, purslane and ragweed. Partial control of quack grass, horsenettle, vetch and yellow nut sedge. **Uptake and Translocation:** Uptake is mostly through roots, although partially through foliage and stem. Translocation is upward into leaves. **Basis of Selectivity:** Used only on established plantings so that roots of crop are below depth to which chemical penetrates. May also be slower translocation and faster degradation in tolerant species. **Application Methods:** Apply to the soil surface in 200–1000 L water/ha. If weed growth is present in apples, paraquat may be mixed with spray. Rates for strawberries are considerably lower and can be applied in spring, post-harvest or late fall. Control of perennial grasses may be improved by cultivation prior to treatment. **Residual Activity:** May be up to 2 years. Residues are likely to be higher on heavier soil types if higher rates and repeated applications are used. **Unique Characteristics:** Moisture is necessary to activate the chemical within 2 weeks after application. Do not apply on soils with less than 1% organic matter, nor on eroded soil areas. Use lower rates on soils with 1%–2% organic matter. Do not apply on weak or diseased strawberry plants.

THIFENSULFURON-METHYL

Trade Name: PINNACLE. **Chemical Family:** Sulfonyl urea. **Crop and/or Non-Crop Registrations:** Soybeans. **Sensitive Weeds:** Redroot pigweed, lamb's-quarters, velvetleaf, lady's-thumb and wild mustard. **Uptake and Translocation:** Following foliar application, the herbicide is rapidly absorbed and translocated in both the xylem and phloem to growing points of sensitive weeds. **Basis of Selectivity:** Inhibition of acetolactase synthase (ALS) enzyme in susceptible plants that leads to a rapid cessation of cell division and plant growth. Tolerant species rapidly metabolize the herbicide into non-phytotoxic metabolites. **Application Method:** Postemergence. **Residual Activity:** Rapid soil microbial degradation. Half-life of 5 days at 25°C soil temperatures. **Unique Characteristics**: Labelled species can be controlled up to 10 cm in height. Redroot pigweed is very sensitive. Typical symptoms of plant death (leaf crinkling, curling, chlorosis) occur 5–10 days after application depending on the growing conditions. Velvetleaf control is greatly enhanced by the inclusion of ammonium containing fertilizer (such as a UAN solution).

THIFENSULFURON-METHYL/ TRIBENURON-METHYL

Trade Name: REFINE EXTRA. **Chemical Family:** Sulfonyl urea. **Crop and/or Non-Crop Registrations:** Wheat (spring,winter, durum), barley, oats not underseeded to legumes or grasses. **Sensitive Weeds:** Lamb's-quarters, annual smartweed (green smartweed, lady's-thumb), chickweed, hemp-nettle, wild buckwheat, cow cockle, stinkweed, Canada thistle, sow-thistle, round-leaved mallow. **Uptake and Translocation:** Following foliar application, is rapidly absorbed and translocated in both xylem and phloem. **Basis of Selectivity:** Inhibition of acetolactate synthase in susceptible plants leads to a rapid cessation of cell division and growth. Tolerant species rapidly convert to non-phytotoxic metabolites. **Application Method:** Postemergence. **Residual Activity:** Rapid soil microbial degradation. **Unique Characteristics:** A non-ionic surfactant must be added. Typical symptoms of plant death (leaf crinkling, curling, chlorosis) occur 5–10 days after application depending on growing conditions. Tank mixes with MCPA and 2,4-D for control of ragweed and mustards.

TRALKOXYDIM

Trade Name: ACHIEVE 40DG AND ACHIEVE 80DG. **Chemical Family:** Cyclohexanedione. **Crop and/or Non-Crop Registrations**: Spring wheat, spring barley. **Sensitive Weeds:** Wild oats. **Uptake & Translocation**: Uptake through the leaves, translocated to growing points of roots, shoots and leaves. **Basis of Selectivity:** Metabolized in tolerant species. **Application Methods:** Postemergence to actively growing wild oats at 1- to 5-leaf stage. Rainfast in 1 hour. **Residual Activity:** none. **Unique Characteristics:** Safe on all varieties of spring wheat and barley. May be applied to cereal crops underseeded to legumes such as clover, alfalfa, sainfoil or bird's-foot trefoil. Do not feed or graze forage in year of treatment.

TRIALLATE

Trade Name: AVADEX BW **Chemical Family:** Thiocarbamate. **Crop and/or Non-Crop Registrations:** Spring wheat and barley, flax, rapeseed, sugar beets, mustard and dry peas.

Sensitive Weeds: Wild oats. **Uptake and Translocation:** Absorbed mainly by the coleoptile of wild oats. **Application Methods:** Postplant incorporated (spring wheat and barley). Preplant incorporated (barley, flax, rapeseed, sugar beets, mustard and dry peas). For postplant treatment of the cereals, the spray is applied to the soil after the crop is seeded and then thoroughly worked into the soil by harrowing twice, the second harrowing at right angles to the first; the crop should be seeded uniformly, deep enough so it is not disturbed by the harrow. For preplanting treatments, the chemical is sprayed on the soil surface and worked into the top 5–8 cm of soil with a disk or cultivator implement. The crop can be seeded anytime after treatment. In all treatments, the chemical should be worked into the soil within 2 hours after spraying. **Residual Activity:** Half-life in soil of approximately 6–8 weeks.

TRICLOPYR

Trade Name: GARLON 4, RELEASE. **Chemical Family:** Pyridine. **Non-Crop Registrations:** GARLON 4 -site preparation for lowbush blueberry, and the control of unwanted woody plants and annual and perennial broadleaf weeds in non-crop areas including rights-of-way, electrical power lines, communication lines, pipelines, roadsides and manufacturing and storage sites. RELEASE silvicultural herbicide is recommended for the control of undesirable woody plants and annual and perennial broadleaf weeds in woodland management. **Sensitive Weeds:** Woody plant species controlled are: alder, ash, aspen, basswood, beech, birch, blackberry, raspberry, buckthorn, cottonwood, dogwood, elderberry, hawthorn, hickory, hop-hornbeam, locust, maples, mulberry, poison-oak, poplar, sumac, willow, honey locust, choke cherry, elm, red maple, oaks and pines. Annual and broadleaf weeds controlled are: burdock, chicory, curled dock, dandelion, field bindweed, lamb's-quarters, ragweed, smartweed, smooth bedstraw, vetch and wild lettuce. **Uptake and Translocation:** Triclopyr is absorbed by both plant leaves and roots. It is readily translocated through plants. It tends to accumulate in meristematic tissues and is not readily metabolized in susceptible plants. **Basis of Selectivity:** Tolerant species such as grasses rapidly metabolize triclopyr. **Application Methods:** For deciduous and certain conifer species use as a foliage spray when brush species are actively growing. Apply either broadcast using a fixed nozzle (constant volume per ha) or selectively using a spray gun (variable volume per ha). As spray gun applications use a dilute spray mix, this type of application must thoroughly wet the foliage, stem and root collar. Brush should be treated after foliage is well developed and actively growing. For conifer release in woodland sites, application should be made in late summer after conifers have hardened off and deciduous trees are in full leaf but prior to autumn coloration. Woody plants may also be controlled by using basal bark, dormant stem and cut-surface treatments. **Residual Activity:** Half-life in soil is approximately 30 days under conditions that are favourable for microbial decomposition. **Unique Characterisitics**: Applications should be made only when there is little or no hazard from spray drift. Small quantities of spray drift may injure susceptible broadleaf plants.

TRIFLURALIN

Trade Names: BONANZA 400, RIVAL, TREFLAN. **Chemical Family:** Dinitroaniline. **Crop and/or Non-Crop Registrations:** Soybeans, dry beans (white or kidney), faba beans, snap beans, lima beans, black beans, canola (rapeseed), triazine-tolerant canola (variety of O.A.C. Triton, pedigreed seed only), sunflowers, turnips, peas (field and canning), direct-seeded alfalfa; transplants of tomatoes, peppers, Brussels sprouts, broccoli, cabbage and cauliflower; carrots, crambe, direct-seeded cabbage and cauliflower, annual flowers, woody ornamental plantings and field-grown nursery stock, perennials, established shelterbelts, strawberries. **Sensitive Weeds:** Effective on most annual grasses, and will provide good control of pigweed and lamb's-quarters, including the triazine-tolerant biotypes of these weeds. **Uptake and Translocation:** No significant absorption or translocation of trifluralin in crops grown in soil treated with trifluralin. Susceptible weeds are controlled as they germinate. Established weeds are not controlled. **Basis of Selectivity:** Physiological growth processes associated with seed germination. **Application Methods:** Preplant incorporated. Apply in 100–300 L of water/ha. Use lower rate of the chemical on sandy soils and increased rate for loam-to-clay soils. Do not use on highly organic soils (muck, peat or black sands above 15% organic matter). Incorporate twice in cross directions using a tandem disc (7–10 km/hr) or tine cultivator (10–13 km/hr) set to work 8–10 cm deep. The first incorporation should be done as soon as possible after application, but may be delayed 8–24 hours, depending on label directions. The second incorporation is recommended anytime before planting. Activated upon incorporation; rainfall is not required. **Residual Activity:** Recommended application rates provide season-long weed control. Succeeding crops, even fall-seeded grain crops planted in soil that received trifluralin the preceding spring, will not be injured under normal conditions. **Unique Characteristics:** Strongly adsorbed to soil particles and shows negligible leaching. Organic matter and clay content influence application rate. Does not control ragweed, annual nightshades or mustards; lady's-thumb may escape.

TRIFLUSULFURON-METHYL

Trade Name: UPBEET. **Chemical Family:** Sulfonylurea. **Crop and/or Non Crop Registrations:** Sugar beets. With BETAMIX on sugar beets. **Sensitive Weeds:** Redroot and green pigweed, velvetleaf. **Uptake And Translocation**: Following foliar application, the herbicide is rapidly absorbed and translocated in both the xylem and phloem to growing points of sensitive weeds. **Basis of Selectivity:** Inhibition of acetolactase synthase (ALS) enzyme in susceptible plants that leads to a rapid cessation of cell division and plant growth.

NB: Trade names and common names of herbicides are cross-referenced in Table 1.

Tolerant species rapidly metabolize the herbicide into non-phytotoxic metabolites.
Application Methods: postemergence. **Residual Activity:** None. **Unique Characteristics**: Must be applied with an approved adjuvant system including 0.2% v/v non-ionic surfactant. Addition of 28% urea ammonium nitrate (U.A.N.) at 2 L/ha will improve weed control. Plant death of target weeds may take from 1-3 weeks for visual symptoms to develop. Symptoms develop more quickly under favourable growing conditions.

TURBOCHARGE

Type of Adjuvant: Surfactant/solvent. **Chemical Composition:** 39.5% surfactant blend plus 50% solvent (mineral oil). **Registered Uses:** For use with ACHIEVE 40 DG herbicide. **Benefit:** Improves chemical effectiveness and provides a greater degree of consistency under varying environmental conditions. **Mode of Action:** Improves spreading of spray droplets on the leaf surface and increases contact surface area. Improves penetration of herbicide through the leaf cuticle layer. **Mixing:** Half-fill spray tank with water, start agitation. Add required amount of herbicide and continue agitation. Add TURBOCHARGE along with remaining water last to the tank. Agitate thoroughly after any stoppage in spraying. Use at a rate of 0.5L TURBOCHARGE/100L of spray mixture. If tank mixing with other herbicides, always add the TURBOCHARGE last.

WATER-SOLUBLE DYES

See AQUASHADE.

XA OIL CONCENTRATE

Type of Adjuvant: Mineral oil/surfactant (non-herbicidal). **Chemical Composition:** Paraffin-base mineral oil 83%, surfactant blend 17%. **Registered Uses:** As a tank mix with atrazine, quizalofop-ethyl, BASAGRAN or bentazon/atrazine. Follow all product labels involved. Care should be taken when applying XA OIL CONCENTRATE on new corn varieties, especially those not treated previously with oil concentrate. Oil concentrates may cause crop injury when applied to a crop that is in a stress condition from extreme weather conditions such as cold weather or hot dry weather and drought. The risk of damage to other vegetation from spray drift is increased with the use of atrazine in oil-water emulsion. Do not add 2,4-D, MCPA, 2,4-DB, cyanazine, MCPB or dicamba or any other herbicide to a mixture of XA OIL CONCENTRATE and atrazine. Do not reduce the rates recommended on the atrazine label. **Benefit:** Improved postemergence activity of herbicides. **Mode of Action:** Partially dissolves waxy cuticle of weeds allowing herbicides to penetrate more readily. Reduces evaporation and aids in spreading of spray droplets on the leaf surface leading to a longer period of penetration. **Mixing:** Avoid violent agitation; partially fill sprayer, add the herbicide, add XA OIL CONCENTRATE last. Tank mix with ATRAZINE: Use 2.75–5.50 L/ha of XA OIL CONCENTRATE plus the recommended amount of atrazine liquid, wettable powder or dry flowable in 200–300 L of water/ha. This is at the rate of 1.25 L XA OIL CONCENTRATE/100 L of water. Tank mix with quizalofop-ethyl: Use 5–10 L of XA OIL CONCENTRATE/1000 L of spray solution. Tank mix with BASAGRAN: Ground Application: 100–400 L/ha. Use 1 L of XA OIL CONCENTRATE/100 L of spray volume to a maximum rate of 2 L/ha. Restrict application rate to 1 L/ha under hot, humid conditions. Aerial Application: 50–100 L/ha. Use 0.125–0.25 L of XA OIL CONCENTRATE/ha. Do not use XA OIL CONCENTRATE in excess of 0.25 L/ha as substantial crop injury could occur. Tank mix with bentazon/atrazine: Use 10 L of XA OIL CONCENTRATE/1000 L of spray solution. **Unique Characteristics:** Some injury may occur with cold, rainy weather when mixed with atrazine on corn.

Table 3. Herbicide Groupings for Ontario

Group[1]	Site of Action	Single modes of action (alphabetic order)	Two or more modes of action (alphabetic order)[2]
1	Inhibitors of acetyl CoA carboxylase (ACCase)	Acclaim Super, Achieve, Assure, Assure II, Excel Super, Fusilade II, Hoe-grass 284, Poast Ultra, Select, Venture 25G	
2	Inhibitors of acetolactate synthase (ALS) and also called acetohydroxyacid synthase (AHAS)	Accent, Arsenal, Classic, Elim EP, Muster, Pinnacle, Peak, Prism, Pursuit, Refine Extra, Reliance STS, Telar, Ultim, Viper	Broadstike Dual(2,15), Broadstike Treflan(2,3), Conquest[3](2,5), Fieldstar(2,4), Patriot(2,5), PeakPlus[3](2,4), Striker(2,4), Ultimax[3](2,4), Valor(2,3), Viper[3](2,14)
3	Microtubule assembly inhibitors	Edge, Bonanza 400, Dimension, Prowl, Rival, Treflan	Broadstrike Treflan(2,3), Valor(2,3)
4	Synthetic auxins	Banvel II, Caliber 400, Cobutox 600, Compitox, Covitox Plus, Dichlorprop-D, Diphenoprop, Dycleer, Dyvel, Embutox 625, Estaprop, Estasol, Estamine 2,4-D, Ester, Expedite Broadleaf, Garlon 4, Kil-Mor, Killex, Lontrel, MCPA, Mecoprop, Mecocrop 2,4-D, Mecoturf Plus 2,4-D, Meco-D, Par III, Premium 3-Way, Release, See 2,4-DB, Target, Tordon 101 mix, Tricep, Turf Herbicide, Turf-Rite 2+2, Turboprop, Weedone CB	Buctril M(4,6), Calmix Pellets(4,5), Distinct(2,19), Fieldstar(2,4), Marksman(4,5), PeakPlus[3](2,4), Shotgun(4,5), Stampede CM(4,7), Striker(2,4), Ultimax[3](2,4),
5	Inhibitors of photosynthesis at photosystem II, Site A	Aatrex, Atrazine, Bladex, Gesagard, Hyvar X, Lexone, Princep Nine-T, Pronone, Pyramin FL, Sencor, Simadex, Simazine, Sinbar, Velpar	Calmix Pellets(4,5), Conquest[3](2,5), Krovar(5,7), Laddok(5,6), Marksman(4,5), Patriot(2,5), Primextra II Magnum(5,15), Primextra Light(5,15), Shotgun(4,5),
6	Inhibitors of photosynthesis at photosystem II, Site A	Basagran, Basagran Forte, Lentagran, Pardner	Buctril M(4,6), Laddok(5,6)
7	Inhibitors of photosynthesis at photosystem II, Site B	Afesin, Afolan F, Betamix, Betanex, Herbec 20P, Karmex, Linuron 480, Lorox, Patoran FL, Spin-Aid	Krovar(5,7), Stampede CM(4,7)
8	Conjugation of acetyl co-enyme A	Avadex BW, Avenge 200C, Betasan, Eradicane, Eptam, Ro-Neet	
9	Inhibitors of 5-enolpyruvylshikimimate-3-phosphate synthase (EPSP)	Clear-It, Credit, Expedite Grass & Weed, EZJect, Glyfos, Laredo, Renegade, Roundup, Touchdown 480, Vantage, Vision, Wrangler	Roundup Fast Forward(9,10)
10	Inhibitors of glutamine synthetase	Liberty 200 SN, Ignite	Roundup Fast Forward(9,10)
11	Inhibitors of carotenoid biosynthesis	Amitrol 240, Amitrol-T	
14	Inhibitors of protoporphyrinogen oxidase (Protox)	Blazer, Goal 2XL, Reflex, Ronstar 2G	Viper[3](2,14)
15	Conjugation of acetyl co-enyme A	Devrinol, Dual, Dual Magnum, Dual II Magnum, Frontier	Broadstrike Dual(2,15), Primextra II Magnum(5,15), Primextra Light(5,15)
19	Inhibitors of auxin transport system	Alanap,	Distinct(2,19)
20	Inhibits cell wall synthesis, Site A	Casoron 4G	

Table 3. Herbicide Groupings for Ontario

Group[1]	Site of Action	Single modes of action (alphabetic order)	Two or more modes of action (alphabetic order)[2]
22	Photo system I - electron diverters	Gramoxone, Reglone, Reglone A, Weed & Grass Killer	
23	Inhibitors of mitosis	CIPC	
27	others	Basamid, Krenite, Vapam	
28	Inhibitors of p-hydroxyphenyl pyruvate dioxygenase (HPPD)		

[1] Herbicide groupings for Ontario follow the Weed Science Society of America's nationally accepted grouping. Groups 12, 13, 16, 17, 18, 21, 24, 25 and 26 are not available in Ontario.

[2] Products with two or more sites of action are followed by the group numbers involved.

[3] Indicates herbicides sold as a co-pack under this trade name

Table 4. Interval Before Rainfall (Post-Emergent)

Rainfall shortly after application of a post-emergent herbicide may reduce the weed control. This effect will vary with the product, the formulation, the interval of time and the drying conditions between application and rainfall, as well as on the amount, intensity, and duration of rainfall.The following information is based on label information and additional detail supplied by the chemical industry. **For further information, contact the manufacturer**. In the case of a tankmix, use the longest time interval of the products being considered.

0 to 15 Minutes	1 Hour	2 Hours	3 Hours	4 Hours	6 Hours	8 Hours	24 Hours
DIMENSION	ACHIEVE	2,4-D Ester	ACCLAIM SUPER	2,4-D amine	AMITROL 240	AFOLAN F	MECOTURF plus 2,4-D
GRAMOXONE	ASSURE II	ACCENT	GOAL 2XL	BANVEL II	AVENGE 200C	LINURON 480	
REGLONE	BUCTRIL M	ARSENAL	TARGET	CLOVITOX PLUS	BASAGRAN	LOROX	
	CALIBER 400	atrazine		DISTINCT	BASAGRAN FORTE		
	COBUTOX 600	BLADEX (L and DF)		DYCLEER	BETAMIX		
	EMBUTOX 625	CLASSIC		DYVEL	BETANEX		
	EXCEL SUPER	ESTAPROP		IGNITE	BLAZER		
	HOE-GRASS 284	ELIM		LIBERTY 200 SN	GLYFOS		
	PARDNER	FUSILADE II		LONTREL	KIL-MOR		
	PATRIOT	GARLON 4		MARKSMAN	LADDOK		
	POAST ULTRA	LENTAGRAN		MCPA amine	LEXONE		
	SELECT	MCPA ester		MUSTER	MCPA sodium		
	WEEDONE CB	PRISM		PEAKPLUS[1]	PYRAMIN FL		
		PURSUIT		PINNACLE	ROUNDUP		
		SHOTGUN		REFINE EXTRA	SENCOR		
		TORDON 101		REFLEX	SPIN-AID		
		ULTIM		RELIANCE STS	STRIKER		
		VENTURE 25DG		ROUNDUP TRANSORB	TOUCHDOWN		
				STAMPEDE CM	ULTIMAX[1]		
				TROPOTOX PLUS			
				UPBEET			
				VIPER[1]			

[1] indicates herbicides sold as a co-pack under this Trade name

Table 5. Herbicide Crop Rotation and Soil pH Restrictions

(For other crops, consult the label)

Trade name	Field Crops																								
	Alfalfa	Barley	Barley (underseeded)	Beans, kidney	Beans, white	Canola, including RR	Canola, IMI Smart	Clover, red	Corn, field including RR, LL, PP	Corn, CL	Corn, seed	Flax—linseed	Oats	Oats (underseeded)	Peanuts	Rye, fall	Rye, fall (underseeded)	Soybeans	Sunflowers	Tobacco	Wheat, spring	Wheat, spring (underseeded)	Wheat, winter	Wheat, winter (underseeded)
	Number of months between application and planting																							
ACCENT	10	10	10	f	10	10	10	10	—	—	f	f	f	f	f	f	f	10	f	f	f	f	4	4
ATRAZINE <1.0 kg ai/ha	10	10	10	10	10	22	22	10	—	—	—	10	10	10	22	10	10	10	22	22	10	10	4	10
ATRAZINE > 1.0 –1.5 kg ai/ha	22	10	22	22	22	22	22	22	—	—	—	10	22	22	22	10	22	10	22	22	10	22	10	22
BROADSTRIKE DUAL, BROADSTRIKE TREFLAN (Soil pH > 7.8 and OM < 2%)	10	10	f	10	10	26	26	10	10	10	10	f	10	f	f	f	f	—	f	f	10	f	4	f
CLASSIC (Soil pH 7.4 and less)	10	10	f	f	10	f	f	f	10	10	f	f	f	f	f	f	f	10	f	f	f	f	3	f
CLASSIC (Soil pH 7.4 to 7.8)	22	22	f	f	10	f	f	f	22	22	f	f	f	f	f	f	f	10	f	f	f	f	3	f
CONQUEST †	22	10	22	22	22	22	22	22	10	10	22	22	22	22	22	22	22	—	22	22	10	22	4	22
ELIM, PRISM	f	10	10	f	10	10	10	10	—	—	f	f	f	f	f	f	f	10	f	f	f	f	4	4
FIELDSTAR (Soil pH < 5.9 or > 7.8)	10	10	f	10	10	26	26	10	—	—	10	f	10	f	f	f	f	10	f	f	10	f	4	f
FRONTIER	10	10	10	—	—	10	10	10	—	—	0	10	10	10	10	10	10	—	10	10	10	10	4	10
LEXONE, SENCOR (Soil pH > 7.5)	10	10	10	10	10	22	22	10	—	—	10	10	10	10	10	10	10	—	10	22	10	10	3.3	10
LONTREL	22	10	22	22	22	10	10	22	22	22	22	10	10	22	22	10	22	22	22	22	10	22	10	22
MUSTER	f	10	f	f	f	—	—	f	f	f	f	f	10	f	f	f	f	10	f	f	10	f	4	f
PATRIOT	22	10	22	10	10	22	22	22	10	—	22	22	22	22	22	22	22	22	22	22	10	22	4	22
PEAK, PEAKPLUS †	22	10	f	f	10	f	f	f	—	—	f	f	10	f	f	f	f	10	f	f	f	f	f	f
PURSUIT	—	10	22	—	—	22	—	22	10	—	22	22	22	22	22	22	22	—	22	22	10	22	3.3	22
REFLEX	f	f	f	—	—	18	18	f	10	10	f	f	f	f	f	f	f	—	f	f	10	f	4	f
RELIANCE STS (Soil pH 7.4 and less)	10	f	f	f	10	f	f	f	10	10	f	f	f	f	f	f	f	10	f	f	f	f	3	f
RELIANCE STS (Soil pH 7.4 to 7.8)	22	22	f	f	10	f	f	f	22	22	f	f	f	f	f	f	f	10	f	f	f	f	3	f
STRIKER	10	10	f	10	10	26	26	10	—	—	10	f	10	f	f	f	f	10	f	f	10	f	4	f
ULTIM	f	10	10	f	10	10	10	10	—	—	f	f	f	f	f	f	f	10	f	f	f	f	4	4
ULTIMAX †	f	10	f	f	f	f	f	f	—	—	f	f	f	f	f	f	f	10	f	f	f	f	4	f
VALOR	18	18	18	18	18	18	18	18	10	10	18	18	18	18	18	18	18	—	18	18	18	18	18	18
VIPER †	f	f	f	f	f	f	f	f	10	10	f	f	f	f	f	f	f	—	f	f	f	f	4	f

— = Registered for use

f = Field bioassay, user assumes liability for all crops not indicated on label

† indicates herbicides sold as a co—pack under this Trade name

Table 5. Herbicide Crop Rotation and Soil pH Restrictions

(For other crops, consult the label)

Trade name	Horticultural Crops																											
	Asparagus	Beans, lima	Beans, snap	Beets, red	Beets, sugar	Broccoli	Brussels sprouts	Cabbage	Carrots	Cauliflower	Celery	Corn,sweet	Cucumber	Garlic	Herbs	Lettuce	Muskmelon	Onions	Parsnips	Peas	Peppers	Potatoes	Pumpkin	Rutabaga	Spinach	Squash	Tomatoes (transplanted)	Watermelon
	Number of months between application and planting.																											
ACCENT	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	10	22	10	22	22	22	22	10	22
ATRAZINE <1.0 kg ai/ha	22	10	10	22	22	22	22	22	22	22	22	—	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
ATRAZINE > 1.0 —1.5 kg ai/ha	22	22	22	22	22	22	22	22	22	22	22	—	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
BROADSTRIKE DUAL, BROADSTRIKE TREFLAN (Soil pH > 7.8 and OM < 2%)	f	10	10	f	f	f	f	f	f	f	f	22	22	f	f	f	f	f	f	10	22	22	f	f	f	f	26	f
CLASSIC (Soil pH 7.4 and less)	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
CLASSIC (Soil pH 7.4 to 7.8)	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
CONQUEST [1]	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
FIELDSTAR	f	10	10	f	f	f	f	f	f	f	f	22	22	f	f	f	f	f	f	10	f	26	f	f	f	f	26	f
FRONTIER	f	f	f	f	f	f	f	f	f	f	f	—	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
LEXONE, SENCOR	—	10	10	22	22	22	22	22	10	22	22	10	22	10	10	22	22	22	10	10	22	—	22	22	22	22	—	22
LONTREL	22	22	22	22	—	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	—	22	22	22	22
MUSTER	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
PATRIOT	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	10	22	22	22	22	22	22	22	22
PEAK, PEAKPLUS [1]	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	10	f	f	f	f	f	f	f	f
PRISM, ELIM EP	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	—	f	f	f	f	—	f
PROWL	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	—	22	22	22	22	22	22	22	22	22	22
PURSUIT	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	—	f	f	f	f	f	f	f	f	f
REFLEX	f	f	—	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
RELIANCE STS (Soil pH 7.4 and less)	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
RELIANCE STS (Soil pH 7.4 to 7.8)	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
SIMAZINE, PRINCEP<2 kg ai/ha	22	22	22	10	22	22	22	22	22	22	22	10	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
SIMAZINE, PRINCEP>2 kg ai/ha	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
STRIKER	f	10	10	f	f	f	f	f	f	f	f	22	22	f	f	f	f	f	f	10	f	26	f	f	f	f	26	f
ULTIM	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
ULTIMAX [1]	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
VALOR	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
VIPER [1]	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	10	f

— = Registered for use

f = Field bioassay, user assumes liability for all crops not listed on label.

[1] indicates herbicides sold as a co-pack under this Trade name

Special Methods Of Weed Control - Preplant-Site Preparation

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see 'Notes on Chemicals' section.)
amitrole AMITROL 240 (231g/L)	1 to 2 kg/ha 4.2 to 8.4 L/ha	 1.68 to 3.36 L/ac	Apply in 100-200 L/ha water (40-180 L/ac) 10-14 days before planting the crop. Soybeans may be planted 6 days after application when applied at the low rate. Use additional herbicide treatments to control weed species that emerge after amitrole application. Amitrole will not provide residual weed control.
amitrole AMITROL 240 (231g/L)	3 to 4 kg/ha 12.5 to 16.5 L/ha	 5 to 6.6 L/ac	ONLY FOR USE BEFORE WHITE BEANS, CORN AND SOYBEANS. Apply to actively weeds up to 10 cm tall and Canada thistle in the fall or spring. Plow or thoroughly disk 10-14 days after application. Cultivation may be required when the crop is emerged.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.27 to 1.26 kg/ha 0.75 to 3.5 L/ha 0.75 to 3.5 L/ha 0.249 to 1.155 kg/ha 0.75 to 3.5 L/ha	 0.3 to 1.4 L/ac 0.3 to 1.4 L/ac 0.3 to 1.4 L/ac	See the product labels for specific details. Glyphosate can be applied to actively growing weeds in the fall, or spring prior to emergence of any crop. Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. Refer to the product label for specific rates for annual weeds. The low rate must be applied 50 to 100 L/ha water (20-40 L/ac). Apply the low rate plus a surfactant if greater volumes of water are used. Higher rates may be applied in 100 to 300 L/ha water (40-120 L/ac).
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.9 to 2.52 kg/ha 2.5 to 7 L/ha 2.5 to 7 L/ha 0.825 to 2.31 kg/ha 2.5 to 7 L/ha	 1 to 2.8 L/ac 1 to 2.8 L/ac 1 to 2.8 L/ac	For perennial grass control apply to actively growing plants with at least 3-4 new leaves. The low rate (2.5 L/ha (1 L/ac)) will provide a minimum of one season control while higher rates (4.75 to 7 L/ha (1.9 to 2.8 L/ac)) will provide longer term control. For dandelion control apply 2.5 L/ha (1 L/ac) if 15 cm or less in diameter and 3.5 to 5 L/ha (1.4 to 2 L/ac) if larger than 15 cm.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	2.52 to 4.32 kg/ha 7 to 12 L/ha 7 to 12 L/ha 2.31 to 3.96 kg/ha 7 to 12 L/ha	 2.8 to 4.8 L/ac 2.8 to 4.8 L/ac 2.8 to 4.8 L/ac	Canada thistle and sow-thistle should be at least in early bud, milkweed at bud, bindweed at full flower, and dogbane past full bloom for best results. All species should be actively growing at application time. Allow 5 to 7 days translocation time after application before doing any tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds. Use the higher rate for best control of solid stands of undisturbed perennials such as sod in non-crop areas. Repeat application to regrowth may be necessary for complete control.
glyphosate/glufosinate ammonium ROUNDUP FASTFORWARD PRESEED ((30:1) 310g/L)	0.465 to 1.302 kg/ha 1.5 to 4.2 L/ha	 0.6 to 1.7 L/ac	0.6 L/ac is recommended mainly for annual grass weeds up to 15 cm in height. 1.1 L/ac is recommended for annual grass and broadleaf weeds up to 15 cm in height. 1.7 L/ac is recommended for annual weeds over 15 cm in height. See label for more details.
glyphosate/glufosinate ammonium ROUNDUP FASTFORWARD PRESEED ((30:1) 310g/L)	0.93 to 2.604 kg/ha 3.0 to 8.4 L/ha	 1.2 to 3.4 L/ac	Use the higher rates for heavier infestations and for dandelions larger than 15 cm. 1.5 L/ac and 2 L/ac are recommended for average quackgrass and dandelion infestations respectively.

paraquat GRAMOXONE (200g/L)	0.55 to 1.1 kg/ha 2.75 to 5.5 L/ha	1.1 to 2.2 L/ac	Apply paraquat to actively growing vegetation at least 3 days prior to crop emergence. Use the high rate when weeds are above 5 cm in height. Apply paraquat in 300 to 1100 L/ha water (120-440 L/ac). Complete coverage is important. Use higher water volumes on dense vegetation. Perennial weeds will only be suppressed. Only emerged weeds will be controlled.
Soil-Seedbed and Inter-Row Weeding			
glufosinate ammonium IGNITE (150g/L)	0.405 to 0.75 kg/ha 2.7 to 5 L/ha	1.08 to 2 L/ac	Apply in a minimum of 110-330 L/ha (44-132 L/ac) of water in carrot, lettuce and onion crops only. IGNITE may be applied as a stale seedbed technique prior to emergence of the crop. See label for more detailed information.
glyphosate ROUNDUP TRANSORB (360g/L) plus surfactant AGRAL 90, AGSURF, ENHANCE	0.27 to 1.26 kg/ha 0.75 to 3.5 L/ha 0.35 L/ha	0.3 to 1.4 L/ac 0.14 L/ac	Till and fertilize soil in early spring. Allow weeds to grow. Spray weeds just before seeding crop. Use low rate for small weeds (8 cm), medium rates for weeds 8 to 15 cm and higher rate for weeds over 15 cm tall. Apply recommended preemergence or postemergence herbicides to control new flushes of weeds or use mechanical means of control.
glyphosate/glufosinate ammonium ROUNDUP FASTFORWARD PRESEED ((30:1) 310g/L)	0.465 to 1.302 kg/ha 1.5 to 4.2 L/ha	0.6 to 1.7 L/ac	0.6 L/ac is recommended mainly for annual grass weeds up to 15 cm in height. 1.1 L/ac is recommended for annual grass and broadleaf weeds up to 15 cm in height. 1.7 L/ac is recommended for annual weeds over 15 cm in height. See label for more details.
glyphosate/glufosinate ammonium ROUNDUP FASTFORWARD PRESEED ((30:1) 310g/L)	0.93 to 2.604 kg/ha 3.0 to 8.4 L/ha	1.2 to 3.4 L/ac	Use the higher rates for heavier infestations and for dandelions larger than 15 cm. 1.5 L/ac and 2 L/ac are recommended for average quackgrass and dandelion infestations respectively.
paraquat GRAMOXONE (200g/L) or diquat REGLONE (200g/L)	0.6 to 1.1 kg/ha 3 to 5.5 L/ha 0.6 to 1.1 kg/ha 3 to 5.5 L/ha	1.2 to 2.2 L/ac 1.2 to 2.2 L/ac	One of these herbicides may be used to kill emerged weeds on a prepared seedbed before the crop seed is sown. Check label for list of crops for which this technique is registered. In inter-row weeding, special low pressure equipment is used to apply the herbicide on emerged weeds without contact with leaves of the crop plants. For small areas, apply 30 mL product in 10 L water per 100 m2.
paraquat/ diquat C.I.L.WEED & GRASS KILLER WEED-BAN	See Label		DOMESTIC - Soluble granular formulations for home garden use. Check label for rates.

Table 6. Non Selective Herbicides Available for Preplant Site Preparation

CROP	AMITROL 240	BASAMID	GRAMOXONE	IGNITE	REGLONE	GLYFOS, ROUNDUP TRANSORB, TOUCHDOWN 480	VAPAM	VORLEX PLUS/ PLUS CP
Field Crops								
corn	X				X	X		
soybeans	X				X	X		
white beans	X					X		
stale seedbed field crops			X			X		
tobacco						X	X	X
zero tillage corn			X			X		
Vegetables								
field vegetable seedbeds		X				X	X	
stale seed beds			X			X		
asparagus				X		X		X
beans					X	X		X
beets				X	X	X		
carrots				X	X	X		
celery						X		X
cole crops					X	X		
corn					X	X		
cucumber					X	X		
eggplant		X				X		X
ginseng						X		X
lettuce		X		X		X		X
melons						X		
onions				X	X	X		X
peas					X	X		
peppers		X				X		
potatoes					X	X		X
rutabaga					X	X		
squash						X		X
tomato		X				X		X
Fruit Crops								
fruit						X	X	
small fruits i.e. strawberries						X		X
Nursery Stock								
woody nursery stock		X				X	X	X
herbaceous ornamentals seed		X				X		X
Turfgrass								
turf seedbeds		X				X		
turf renovation			X			X		

Notes:

Weed control ratings are given as 0-9 where 0 indicates no control and 9 indicates 90%-100% control under ideal conditions.

Ratings are subjective values based on best available information and give general comparisons based on use as descibed in this guide.

Under unfavorable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used.

Ratings in **BOLD** suggest the weed is listed on the product label for control or suppression.

Please see product label for more information on registered weed species, product uses and precautions.

Table 7. Preplant Herbicide Weed Control Ratings

				Perennials															
Treatment	**Trade Name**	annual grasses	annual broadleaves	bindweed, field	chickweed, mouse-eared	dandelion	golden-rod	ground-ivy (creeping Charlie)	horsetail	mallow	milkweed	nutsedge	plantains	poison ivy	quackgrass	sow-thistle	thistle, Canada	vetches
preplant herbicides																		
amitrole	AMITROL 240	**	**	[a]	?	**9**	[a]	?	7	?	[a]	[a]	8	8	**7**	[a]	**7**	?
glyphosate	GLYFOS, ROUNDUP, TOUCHDOWN	**	**	**7**[a]	**9**	**7/8**[d]	?	5	0	5	[a]	**7**	**9**	**8**	**8/9**	[a]	**7**[a]	5
glufosinate ammonium	IGNITE	**	**	8[c]	?	**8**	?	?	7[c]	?	6[c]	7[c]	?	?	8[c]	8[c]	8[c]	?
paraquat	GRAMOXONE	**	**	[b]	[b]	[b]	?	[b]	[b]	[b]	[b]	0	[b]	[b]	**5**	[b]	0	[b]

** Indicates that most annual weeds will be controlled if emerged.

? Insufficient information available to make a rating

[a] Optimum growth stages for best control of these weeds will not likely be attained prior to planting in early to mid spring.

[b] Top growth only, regrowth can be expected.

[c] repeated applications may be necessary

[d] use higher rates for plants over 15 cm tall or across

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
Post Harvest			
Post Harvest Broadleaf Herbicides			
2,4-D	0.85 to 1.555 kg/ha		Apply in the fall at the time of rapid growth. Use the higher rate for legumes and perennial weeds. For best results apply to actively growing vegetation at least 2 weeks before a killing frost. DO NOT apply before fall wheat or barley.
ESTASOL (564g/L)	1.5 to 2.75 L/ha	0.6 to 1.1 L/ac	
ESTER 600 (564g/L)	1.5 to 2.75 L/ha	0.6 to 1.1 L/ac	
ESTER 700 (660g/L)	1.29 to 2.36 L/ha	0.52 to 0.94 L/ac	
2,4-D/ dicamba/ mecoprop	0.534 to 0.849 kg/ha		Ground application only. DO NOT apply if wind velocity exceeds 8 km/hr. Apply in 200 L/ha water (80 L/ac).
KIL-MOR (485g/L)	1.1 to 1.75 L/ha	0.44 to 0.7 L/ac	
dicamba	1.2 kg/ha		Apply in the fall to actively growing vegetation at least 2 weeks prior to a killing frost. DO NOT apply before fall seeded crops. Grow only cereals, soybeans, field corn, sweet corn or white beans the year after application of BANVEL II at 2.5 L/ha (1 L/ac). Refer to "Notes on Chemicals" and product label for registered rates of BANVEL II, surfactants tank mixes and appropriate water volumes.
BANVEL II (480g/L)	2.5 L/ha	1 L/ac	
Post Harvest (Grass and Broadleaf Herbicides)			
amitrole	3 to 4 kg/ha		Apply after harvest when regrowth is 10 to 15 cm tall for Canada thistle and sowthisle. Allow 2 weeks before working (cultivation). DO NOT apply after a heavy frost, generally after Oct. 1. DO NOT plant to a crop for 8 months after treatment.
AMITROL 240 (231g/L)	12.5 to 16.5 L/ha	5 to 6.6 L/ac	
dicamba	0.6 kg/ha		Apply in the fall to actively growing vegetation at least 2 weeks prior to a killing frost. DO NOT apply before fall seeded crops. Grow only cereals, soybeans, field corn, sweet corn or white beans the year after application of BANVEL II at 2.5 L/ha (1 L/ac). Refer to "Notes on Chemicals" and product label for registered rates of BANVEL II, surfactants, tank mixes and appropriate water volumes.
BANVEL II (480g/L)	1.25 L/ha	0.5 L/ac	
plus glyphosate	0.6 kg/ha		
ROUNDUP (356g/L)	1.7 L/ha	0.68 L/ac	
plus non-ionic surfactant	0.35 L/ha	0.14 L/ac	
glyphosate	0.9 to 2.52 kg/ha		For perennial grass control apply to actively growing plants with at least 3-4 new leaves. The low rate (2.5 L/ha (1 L/ac)) will provide a minimum of one season control while higher rates (4.75 to 7 L/ha (1.9 to 2.8 L/ac)) will provide longer term control. For dandelion control apply 2.5 L/ha (1 L/ac) if 15cm or less in diameter and 3.5 to 5 L/ha (1.4 to 2 L/ac) if larger than 15 cm.
ROUNDUP TRANSORB (360g/L)	2.5 to 7 L/ha	1 to 2.8 L/ac	
GLYFOS (360g/L)	2.5 to 7 L/ha	1 to 2.8 L/ac	
or glyphosate TMS	0.825 to 2.31 kg/ha		
TOUCHDOWN 480 (330g/L)	2.5 to 7 L/ha	1 to 2.8 L/ac	
glyphosate	2.52 to 4.32 kg/ha		Apply when regrowth is at least 20-25 cm tall or in the bud to bloom stage. The more growth present the better the results. Use higher rates for heavy infestations.
ROUNDUP TRANSORB (360g/L)	7 to 12 L/ha	2.8 to 4.8 L/ac	
GLYFOS (360g/L)	7 to 12 L/ha	2.8 to 4.8 L/ac	
or glyphosate TMS	2.31 to 3.96 kg/ha		
TOUCHDOWN 480 (330g/L)	7 to 12 L/ha	2.8 to 4.8 L/ac	

Notes:

Weed control ratings are given as 0-9 where 0 indicates no control and 9 indicates 90%-100% control under ideal conditions.

Ratings are subjective values based on best available information and give general comparisons based on use as descibed in this guide.

Under unfavorable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used.

Ratings in **BOLD** suggest the weed is listed on the product label for control or suppression.

Please see product label for more information on registered weed species, product uses and precautions.

Table 8. Post Harvest Weed Control

		Grasses		Perennial Broadleaf Weeds								
Crop Stubble	**Treatment**	quackgrass	wire stem muhly	field bindweed	chickweed, mouse-eared	colt's-foot	dandelion	hemp dogbane	milkweed	ground cherry	thistle, Canada	sow-thistle
post harvest herbicides												
glyphosate	GLYFOS, ROUNDUP, TOUCHDOWN	**9**	**9**	**9**	**9**	**8**	**8/9[a]**	**8**	**8**	?	**9**	**9**
dicamba	BANVEL II	0	0	**8**	9	7	8	8	7	6	**8**	**9**
2,4-D/ mecoprop/ dicamba	KILMOR	0	0	**8**	9	?	8	2	0	?	**7**	8
2,4-D	2,4-D *	0	0	**7**	2	?	**7**	?	0	?	**6**	**7**

? Insufficient information available to make a rating

* various products available

[a] Use higher rates for weeds larger than 15 cm tall or across

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
Spot Treatment			
[illegible]			
amitrole AMITROL 240 (231g/L)	3 to 4 kg/ha 12.5 to 16.5 L/ha	5 to 6.6 L/ac	REGISTERED FOR NON-CROP LAND AND PASTURE. Thoroughly wet all leaves and stems of weeds. Refer to label for appropriate stage of weed growth. Repeat applications when new growth appears. DO NOT let livestock eat treated vegetation. Keep livestock off treated area until weeds are dead and new growth has emerged.
glyphosate EXPEDITE GRASS & WEED (147g/L)	0.88 to 1.25 kg/ha 6 to 8.5 L/ha	2.4 to 3.4 L/ac	EXPEDITE herbicides are ready-to-use products which must be applied with the EXPEDITE application system. This low volume application should not be applied "spray to wet" or runoff. Material should be calibrated for proper use rate prior to application. Consult label for calibration and application instructions.
glyphosate EXPEDITE GRASS & WEED (147g/L)	1.25 to 2.5 kg/ha 8.5 to 17 L/ha	3.4 to 6.8 L/ac	EXPEDITE herbicides are ready-to-use products which must be applied with the EXPEDITE application system. This low volume application should not be applied "spray to wet" or runoff. Material should be calibrated for proper use rate prior to application. Consult label for calibration and application instructions.
glyphosate EXPEDITE GRASS & WEED (147g/L)	2.5 to 4.265 kg/ha 17 to 29 L/ha	6.8 to 11.6 L/ac	EXPEDITE herbicides are ready-to-use products which must be applied with the EXPEDITE application system. This low volume application should not be applied "spray to wet" or runoff. Material should be calibrated for proper use rate prior to application. Consult label for calibration and application instructions.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.36 kg/100L 1 L/100L 1 L/100L 0.33 kg/100L 1 L/100L		See label for appropriate stage of weed development and for a list of crops for which this technique is registered.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.72 kg/100L 2 L/100L 2 L/100L 0.66 kg/100L 2 L/100L		See label for appropriate stage of weed development and for a list of crops for which this technique is registered.
[illegible]			
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.36 kg/2L water 1 L/2L water 1 L/2L water 0.33 kg/2L water 1 L/2L water		Apply to weeds which extend above the crop sufficiently to allow good contact with the application equipment. Be careful not to contact the crop with the equipment to allow the chemical solution to drip from the applicator on to the crop. A 33% herbicide mixture (1 L to 2 L of water) provides good control of most weeds.

Beans (White, Kidney, Lima and Snap)

All treatments should be applied in 150 to 300 L/ha (60-120 L/ac) water unless otherwise specified.

Cultivation, rotation and other cultural practices are effective weed control techniques that should be considered along with herbicide treatments when developing a weed control program. Any single method of weed control or the continuous use of the same chemical can lead to the build up of weeds resistant or tolerant to that control method. Rotation to other crops and/or other control methods will reduce the chance of developing new or unique weed infestations.

High speed (10-20 km/hr) shallow (2.5 to 3 cm) cultivation with a rotary hoe when the beans are in the 1 to 2 leaf stage will help to control small weed seedlings. This technique will not reduce herbicide action and may in some years enhance chemical weed control and improve crop safety.

Inter-row cultivation may be required when weeds escape herbicide treatment; weeds should be considered as escapes when they are 5 to 7 cm high. Cultivation should be shallow to prevent exposure of untreated soil and germination of new weed seeds.

Band treatment of chemical over the row will reduce costs by one-half to two-thirds, depending on the row spacing and width of band. Shallow inter-row cultivation will be required to control weeds between the bands.

Cultivation will give some control of established perennial weeds but may also help to spread them to previously uninfested areas. Machinery sanitation is important when moving from one field to another. Many perennials can be spread on tillage equipment. Where possible it is always a good idea to till fields with perennial weeds last. Custom operators should be particularly careful when moving from one farm to another. For additional information see the section on preventative weed control in this publication.

Some chemicals may also be impregnated on dry bulk fertilizer. Check the label for recommended fertilizer ingredients. Please refer to Beans (White, Kidney, Lima and Snap) Weed Control Ratings Table to determine which market classes of edible beans are registered for the herbicide treatments listed.

Rates and application techniques vary for trifluralin products. For further information on these and other chemicals refer to label recommendations and also the "Notes on Chemicals" section in this publication.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Soil Applied Grass Herbicides

dimethenamid	1 to 1.25 kg/ha		•Apply PPI or PRE.
FRONTIER (900g/L)	1.1 to 1.4 L/ha	0.44 to 0.56 L/ac	•Incorporation equipment should be set to work no deeper than 10 cm. •Control of yellow nutsedge is obtained when FRONTIER is applied PPI. •Minimum PPI rate is 1.125 kg/ha (0.5 L/ac). •Use the higher rate of FRONTIER for the control of nightshade and pigweed. •DO NOT USE on muck, peat or high organic matter soils. •USE ON WHITE AND KIDNEY BEAN VARIETIES ONLY.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
EPTC EPTAM (800g/L)	3.4 to 4.4 kg/ha 4.25 to 5.5 L/ha	1.7 to 2.2 L/ac	•Apply Preplant incorporated. If dry weather has preceded the application of EPTC, delay seeding 7 to 10 days. •Temporary injury can occur in the emerging crop. •Use the high rate for nutsedge control
EPTC EPTAM (800g/L) plus ethalfluralin EDGE (60 DC)	2.4 kg/ha 3 L/ha 0.72 kg/ha 1.2 kg/ha	 1.2 L/ac 0.48 kg/ac	•Apply Preplant incorporated Incorporate immediately. •CAUTION: DO NOT use on highly organic soils.
EPTC EPTAM (800g/L) plus trifluralin TREFLAN EC (480g/L) RIVAL (500g/L) BONANZA 400 (400g/L)	2.4 kg/ha 3 L/ha 0.6 kg/ha 1.25 L/ha 1.2 L/ha 1.5 L/ha	 1.2 L/ac 0.5 L/ac 0.48 L/ac 0.6 L/ac	•Apply Preplant incorporated.
ethalfluralin EDGE (60 DC)	0.66 to 1.14 kg/ha 1.1 to 1.9 kg/ha	 0.44 to 0.76 kg/ac	•Apply Preplant incorporated.
s-metolachlor DUAL MAGNUM (915g/L)	1.05 to 1.6 kg/ha 1.15 to 1.75 L/ha	 0.44 to 0.7 L/ac	•Apply Preplant incorporated. S-metolachlor must be preplant incorporated before seeding the crop. •Incorporation equipment should be set to work no deeper than 10 cm. •DO NOT USE on muck, peat or high organic matter soils.
trifluralin TREFLAN EC (480g/L) RIVAL DF (60 DF) BONANZA 400 (400g/L)	0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1 to 1.9 kg/ha 1.5 to 2.75 L/ha	 0.5 to 0.96 L/ac 0.4 to 0.76 kg/ac 0.6 to 1.1 L/ac	•Apply Preplant incorporated. Incorporate as soon as possible and within 24 hours •DO NOT exceed 1.2 L/ha (0.48 L/ac) of TREFLAN in medium textured soils and 1.7 L/ha (0.68 L/ac) in heavy textured soils for lima beans.
Soil Applied Broadleaf Herbicides			
metobromuron PATORAN FL (400g/L)	1 to 1.7 kg/ha 2.5 to 4.25 L/ha	 1 to 1.7 L/ac	•Apply preemergent. •DO NOT exceed 1.17 kg/ha (active) for kidney beans or snap beans. Beans should be seeded at least 5 cm deep. •Injury may occur if beans are under stress or from treated soil having been splashed up onto the leaves by a rainstorm. A shallow harrowing or rotary hoeing after application of the chemical will reduce the possibility of splash up as well as help activate the chemical if dry weather follows application. •Cultivation may be required with the low rate when applied sequentially after a preplant incorporated treatment.
monolinuron AFESIN (200g/L)	0.75 to 1.4 kg/ha 3.75 to 7 L/ha	 1.5 to 2.8 L/ac	•Apply preemergent. •Do not use on soils less than 3% organic matter. •Beans should be seeded at least 5 cm deep. Shallow planted crops may be injured if heavy rains follow application. A shallow harrowing or rotary hoeing after application of the chemical will reduce the possibility of splash up as well as help activate the chemical if dry weather follows application. •Use the low rate when applied sequentially after a preplant incorporated treatment.

imazethapyr PURSUIT (240g/L)	0.075 kg/ha 0.312 L/ha	0.125 L/ac	•Apply preemergent. •Heavy infestations of ragweed or proso millet require a tank mix (see below). •May be used on all soil types. Some rotational cropping restrictions. •DO NOT use on Lima beans
imazethapyr PURSUIT (240g/L) plus metobromuron PATORAN FL (400g/L)	0.075 kg/ha 0.312 L/ha 1 to 1.2 kg/ha 2.5 to 3 L/ha	0.125 L/ac 1 to 1.2 L/ac	•Apply preemergent.

Postemergent Grass Herbicides

diclofop-methyl HOE-GRASS 284 (284g/L)	1 kg/ha 3.5 L/ha	1.4 L/ac	•DO NOT apply if rain is expected within one hour after application. •Apply when grasses are 1-4 leaf stage (2-3 is optimum).
fenoxaprop-p-ethyl EXCEL SUPER (80.5g/L)	0.054 kg/ha 0.67 L/ha	0.27 L/ac	•Treat at the 1to 6 leaf stage of annual grass.
sethoxydim POAST ULTRA (450g/L) plus oil concentrate ASSIST or surfactant MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha 1 L/ha	0.13 to 0.19 L/ac 0.8 L/ac 0.4 L/ac	•Use higher rate for volunteer spring cereals. •Treat the 1 to 6 leaf stage of annual grass. •Apply using 110 to 200 L/ha of water (44-80 L/ac).
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 1 to 2 L/ha	0.45 L/ac 0.4 to 0.8 L/ac	•For quackgrass control. Thorough preplant tillage will ensure more uniform quackgrass emergence. Follow with a cultivation 7 days after treatment in wide row crops. •This higher rate is not registered on snap beans •Apply using 100 to 200 L/ha of water (40-80 L/ac).

Postemergent Broadleaf Herbicides

bentazon BASAGRAN (480g/L) plus fomesafen REFLEX (240 g/L) plus oil concentrate ASSIST	0.84 kg/ha 1.75 L/ha 0.14 kg/ha 0.58 L/ha 2 L/ha	0.7 L/ac 0.23 L/ac 0.8 L/ac	•FOR USE ON WHITE AND KIDNEY BEAN VARIETIES ONLY. •Refer to the BASAGRAN label and the REFLEX label for information on specific weed heights, application information, precautions, and use limitations.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
bentazon BASAGRAN FORTE (480g/L) or BASAGRAN (480g/L) plus oil concentrate ASSIST	0.84 to 1.08 kg/ha 1.75 to 2.25 L/ha 1.75 to 2.25 L/ha 2 L/ha	 0.7 to 0.9 L/ac 0.7 to 0.9 L/ac 0.8 L/ac	•No adjuvant is required with BASAGRAN FORTE. •For annual broadleaf weeds apply when beans are in unifoliate to 4th trifoliate leaf stage and weeds are small and actively growing. Many annual broadleaf weeds are controlled including velvetleaf (15 cm/up to 6 leaf), smartweed (20 cm/up to 10 leaf) and cocklebur (30 cm/up to 10 leaf). Use the 2.25 L/ha (0.9 L/ac) rate for annual broadleaf weeds. •Two applications of 1.75 L/ha (0.7 L/ac) 10 days apart may be required to control the perennial weeds. •BASAGRAN FORTE IS NOT REGISTERED FOR SNAP BEANS.
fomesafen REFLEX (240 g/L) plus adjuvant AGRAL 90	0.24 kg/ha 1 L/ha 0.25 % v/v in 200-350 L/ha water	 0.4 L/ac 0.25 % v/v in 80-140 L/ac water	•Apply early postemergence at 1-2 trifoliate to crop, when weeds are small and actively growing (2-4 leaf stage). •Use higher rates of water and pressure for a heavy weed or crop canopy. Some bronzing may occur to bean leaves at the time of application, but plants outgrow these effects without harming maturity or yield. •DO NOT apply REFLEX to any field more often than once every two years. •DO NOT apply to crop under stress. •Some rotational cropping restrictions apply.
fenoxaprop-p-ethyl EXCEL SUPER (80.5g/L) plus bentazon BASAGRAN (480g/L) plus oil concentrate ASSIST	0.054 kg/ha 0.67 L/ha 0.84 to 1.08 kg/ha 1.75 to 2.25 L/ha 2 L/ha	 0.27 L/ac 0.7 to 0.9 L/ac 0.8 L/ac	•Temporary crop injury may occur under abnormally hot, humid conditions. Reduce the oil concentrate to 1 L/ha (0.4 L/ac) when these conditions occur. •If broadleaf and grass weeds are not in the correct leaf stage for a tank-mix application, use a split application at the correct stage for each product.
diquat REGLONE (200g/L) plus surfactant AGRAL 90 or AG-SURF or REGLONE PRO (200g/L)	0.3 to 0.55 kg/ha 1.5 to 2.75 L/ha 0.1 % v/v 1.5 to 2.75 L/ha	 0.6 to 1.1 L/ac 0.1 % v/v 0.6 to 1.1 L/ac	•Use 1.5 to 2 L/ha by ground and 2 to 2.75 L/ha for aerial applications. •Use higher for heavy canopy of crop or weeds. •Apply at 80% natural leaf defoliation and 80% of the pods have turned yellow. •Avoid regrowth by targeting spray within 7 days of bean variety maturity date and harvest 5-7 days after application. •DO NOT USE ON LIMA BEANS or SNAP BEANS.

glufosinate ammonium IGNITE (150g/L)	0.375 to 0.45 kg/ha 2.5 to 3 L/ha	 1 to 1.2 L/ac	•DO NOT apply by air. •DO NOT apply to dry beans grown for seed. •Apply when approximately 50-75% of the bean pods have naturally changed colour from green to yellow or brown. •Use the higher rate when the crop canopy is dense and/or there are high populations of weeds present at application. •The crop may be harvested when ready, allowing a minimum of 9 days after application. IGNITE, when applied to dry beans at the appropriate stage, will uniformly dry down the crop and weeds, facilitating harvest and preventing bean staining. Any secondary growth will be terminated, and moisture levels in the seed will be reduced, allowing for earlier harvest. •Apply in a minimum of 110 L/ha (44 L/ac) of water at a pressure of 275 kPa (40 psi). Where crop canopy is dense, or weed growth is heavy, apply 170-220 L/ha (68-88 L/ac) of water.
glyphosate ROUNDUP TRANSORB (360g/L) TOUCHDOWN 480 (330g/L) GLYFOS (360g/L)	0.9 kg/ha 2.5 L/ha 2.5 L/ha 2.5 L/ha	 1 L/ac 1 L/ac 1 L/ac	•DO NOT USE ON SNAP BEANS. •DO NOT apply to crops grown for seed. •DO NOT apply by air. •Apply in 50 to 100 L/ha (20-40 L/ac) of water when the crop is 30% grain moisture or less (yellow to brown pod colour, 80-90% leaf drop, consult label for more details). •Apply at least 7 days prior to harvest.
glyphosate/glufosinate ammonium ROUNDUP FASTFORWARD PREHARVEST (18.75:1) 316g/L)	0.948 kg/ha 3 L/ha	 1.2 L/ac	•DO NOT USE ON SNAP BEANS. •DO NOT apply to crops grown for seed. •DO NOT apply by air. •Apply in 50-100 L/ha of water when the crop is 30% grain moisture or less (yellow to brown pod colour) Consult label for visual indicators. •Apply at least 7 days prior to harvest. Green vegetation will burndown faster than with ROUNDUP TRANSORB or ORIGINAL.

Notes:

Weed control ratings are given as 0-9 where 0 indicates no control and 9 indicates 90%-100% control under ideal conditions.

Ratings are subjective values based on best available information and give general comparisons based on use as descibed in this guide.

Crop tolerance ratings are E - Excellent, G - Good, F - Fair, P - Poor.

Under unfavorable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used.

Ratings in **BOLD** suggest the weed is listed on the product label for control or suppression.

Please see product label for more information on registered weed species, product uses and precautions.

Table 9. Beans (White, Kidney, Lima And Snap) Herbicide Weed Control Ratings

		Crop Registrations										Annual Grasses						Annual Broadleaves								Perennials							
Treatment	**Trade Name**	Adzuki Beans	Black Beans	Dutch Brown	Cranberry Beans	Kidney Beans	Lima Beans	Pinto Beans	Snap Beans	Yellow Eye	White Beans	barnyard grass	crabgrass	fall panicum	foxtail	old witch grass	proso millet	buckwheat, wild	lady's-thumb	lamb's-quarters	mustards	nightshades, annua	pigweeds	ragweed	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	**Crop Tolerance**
soil applied grass herbicides																																	
dimethenamid	FRONTIER					✓					✓	**9**	**9**	**8/9[a]**	**9**	**9**	7	2	2	7	2	**8/9[c]**	**7/8**	2	2	0	0	0	**8/9[b]**	0	0	0	G
EPTC	EPTAM		✓	✓	✓	✓		✓	✓	✓	✓	**9**	**9**	**9**	**9**	**9**	7	2	7	**7**	5	8	**7**	5	5	?	?	?	**8**	**7**	?	?	E
s-metolachlor	DUAL MAGNUM					✓	✓	✓	✓		✓	**9**	**9**	**8/9[a]**	**9**	**9**	7	2	2	7	2	**8/9[c]**	**7/8**	2	2	0	0	0	**8/9[b]**	0	0	0	G
trifluralin	RIVAL, TREFLAN or BONANZA 400		✓	✓	✓	✓	✓	✓	✓	✓	✓	**9**	**9**	9	**9**	9	7	**5**	2	**8**	2	2	**8**	2	2	2	2	2	2	2	2	2	E
soil applied broadleaf herbicides																																	
metobromuron	PATORAN	✓				✓	✓	✓	✓		✓	**5**	**5**	5	**5**	**5**	5	8	**9**	**9**	**9**	7	**9**	**8**	6	2	2	2	2	2	2	2	G
monolinuron	AFESIN					✓	✓		✓	✓	✓	**5**	**5**	5	**5**	5	5	**8**	**9**	**9**	9	7	**9**	**8**	6	2	2	2	2	2	2	2	G
soil applied grass and broadleaf herbicides																																	
imazethapyr	PURSUIT					✓			✓		✓	8	7	7	**9**	8	**7**	8	**9**	**9**	**9**	**9**	**9**	**8**	**9**	2	2	2	2	6	2	2	G
postemergent grass herbicides																																	
diclofop-methyl	HOE-GRASS 284					✓	✓		✓		✓	**8**	**5**	**8**	**8**	**8**	3	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	E
fenoxaprop-p-ethyl	EXCEL SUPER					✓			✓		✓	**9**	**8**	**9**	**9**	**9**	**9**	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	E
sethoxydim	POAST ULTRA[1]	✓	✓		✓	✓	✓	✓	✓[1]	✓	✓	**9**	**8**	**9**	**9**	**9**	**9**	0	0	0	0	0	0	0	0	0	0	0	0	**6**	0	0	E

Table 9. Beans (White, Kidney, Lima And Snap) Herbicide Weed Control Ratings

Treatment	Trade Name	Crop Registrations										Annual Grasses						Annual Broadleaves								Perennials							Crop Tolerance
		Adzuki Beans	Black Beans	Dutch Brown	Cranberry Beans	Kidney Beans	Lima Beans	Pinto Beans	Snap Beans	Yellow Eye	White Beans	barnyard grass	crabgrass	fall panicum	foxtail	old witch grass	proso millet	buckwheat, wild	lady's-thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	
postemergent broadleaf herbicides																																	
bentazon	BASAGRAN, BASAGRAN FORTE		✓		✓	✓	✓	✓		✓	✓	0	0	0	0	0	0	6	**9**	**8**	**9**	7	**7**	**8**	9	**5**	2	2	**8**	1	5	**7**	G
fomesafen	REFLEX					✓			✓		✓	0	0	0	0	0	0	8	**8**	**6**	**9**	**8**	**9**	**9**	**6**	?	?	?	?	?	?	?	F

* Various formulations available, see Table 1.

? Insufficient information available to make a rating

[1] POAST ULTRA (quackgrass rate - 1.1 L/ha) is not registered for use on snap beans.

[a] Use the high rate of herbicide for optimum control

[b] Use PPI timing for optimum control

[c] Use PRE timing for optimum control

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)

Canola - Spring Planted

PREPLANT - See under **PREPLANT - SITE PREPARATION** for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Preemergent Grass Herbicides

ethalfluralin EDGE (60 DC)	0.66 to 1.14 kg/ha 1.1 to 1.9 kg/ha	 0.44 to 0.76 kg/ac	•Soil incorporation is required. All in line screens should be 50 mesh or coarser. •Strongly absorbed to soil particles, negligible leaching.
trifluralin TREFLAN EC (480g/L) RIVAL DF (60 DF) BONANZA 400 (400g/L)	0.6 to 1.147 kg/ha 1.25 to 2.4 L/ha 1 to 1.9 kg/ha 1.5 to 2.75 L/ha	 0.5 to 0.96 L/ac 0.4 to 0.76 kg/ac 0.6 to 1.1 L/ac	•Soil incorporation is required. •Strongly absorbed to soil particles, negligible leaching.

Postemergent Grass Herbicides

clethodim SELECT (240g/L) plus surfactant AMIGO	0.03 to 0.045 kg/ha 0.13 to 0.19 L/ha 0.50 % v/v	 0.05 to 0.08 L/ac 0.50 % v/v	•Canola is tolerant at all growth stages. •Apply to annual grasses and volunteer cereals in the 2 to 6 leaf stage of growth. •Suppression of quackgrass when applied at the higher dose. •No soil residual soil activity.
diclofop-methyl HOE-GRASS 284 (284g/L)	0.7 to 0.8 kg/ha 2.5 to 2.8 L/ha	 1 to 1.12 L/ac	•Apply to annual grasses in the 1 to 4 leaf stage of growth. •Canola is tolerant at all growth stages. •No soil residual activity. •Tank mixtures with broadleaf herbicides will result in reduced weed control. •Broadleaf herbicides must be applied at least 4 days before or after diclofop-methyl.
fenoxaprop-p-ethyl EXCEL SUPER (80.5g/L)	0.054 kg/ha 0.67 L/ha	 0.27 L/ac	•Apply to annual grasses in the 1 to 6 leaf stage of growth. •No soil residual activity. •Canola is tolerant at all growth stages. •This treatment will not control volunteer winter wheat.
fluazifop-p-butyl VENTURE 25G (25 DG) plus mineral oil/surfactant TURBOCHARGE	0.125 to 0.175 kg/ha 0.5 to 0.7 kg/ha 0.5 % v/v	 0.2 to 0.28 kg/ac 0.5 % v/v	•Apply to annual grasses in the 2 to 5 leaf stage of growth and 3 to 5 leaf stage of quackgrass. •Use the 0.7 kg/ha (0.28 kg/ac) rate for a mixed stand of annual grasses and quackgrass. •No soil residual activity. •DO NOT apply Venture to canola later than the 5th leaf stage of crop growth.

quizalofop-p-ethyl ASSURE II (96g/L) plus oil concentrate CANPLUS 411 or SURE-MIX	0.036 to 0.072 kg/ha 0.375 to 0.75 L/ha 0.5 to 1 % v/v 0.5 % v/v	 0.15 to 0.3 L/ac 0.5 to 1 % v/v 0.5 % v/v	•Apply to annual grasses and volunteer cereals in the 2 leaf to tillering stage and to quackgrass in the 2 to 6 leaf stage of growth. •Canola is tolerant at all growth stages. •No soil residual activity. •Use the higher rate of CANPLUS 411 when wild oats and quackgrass are the target weeds or under drought conditions. •DO NOT apply to canola within 64 days of harvest.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 1 to 2 L/ha	 0.13 to 0.19 L/ac 0.4 to 0.8 L/ac	•Canola is tolerant at all growth stages. •No soil residual activity.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 1 to 2 L/ha	 0.45 L/ac 0.4 to 0.8 L/ac	•Thorough preplant tillage will provide more uniform quackgrass emergence. •Apply to quackgrass in the 1 to 3 leaf stage of growth.

Postemergent Broadleaf Herbicides

clopyralid LONTREL 360 (360g/L)	0.15 to 0.2 kg/ha 0.42 to 0.56 L/ha	 0.17 to 0.22 L/ac	•Apply one postemergence application per season at the 2 to 6 leaf stage of canola. •Apply to Canada thistle at the rosette to pre-bud stage. •Recommended for use ONLY on the following cultivars: Cyclone, Ebony, Jewel, 46A65 and Hyola 401.
ethametsulfuron-methyl MUSTER (75 DF) plus surfactant AGRAL 90, AGSURF, CITOWETT PLUS, or COMPANION	11 g/ha 15 g/ha 2 L/1000 L	 6 g/ac 2 L/1000L	•Apply when the wild mustard in the cotyledon to 6 leaf stage, before the crop begins to bolt. •DO NOT plant to any crop except winter wheat in the year of treatment. •DO NOT feed or graze treated crop within 60 days of application. •DO NOT apply MUSTER tank mix to Polish varieties of canola as crop injury may result.

Postemergent Grass and Broadleaf Herbicides

fluazifop-p-butyl VENTURE 25 G (25 DG) plus ethametsulfuron-methyl MUSTER (75 DF) plus mineral oil/surfactant TURBOCHARGE	0.125 to 0.175 kg/ha 0.5 to 0.7 kg/ha 11 g/ha 15 g/ha 0.5 % v/v	 0.2 to 0.28 kg/ac 6 g/ac 0.5 % v/v	•Add MUSTER to the tank mix first and agitate before adding VENTURE 25 G. Add TURBOCHARGE last. •DO NOT apply MUSTER tank mix to Polish varieties of canola as crop injury may result. •DO NOT apply Venture to canola later than the 5th leaf stage of crop growth.
fluazifop-p-butyl VENTURE 25G (25DG) plus clopyralid LONTREL 360 (360g/L) plus adjuvant TURBOCHARGE	0.125 to 0.175 kg/ha 0.5 to 0.7 kg/ha 0.15 to 0.2 kg/ha 0.42 to 0.56 L/ha 0.5 % v/v	 0.2 to 0.28 L/ac 0.17 to 0.22 L/ac 0.5 % v/v	•DO NOT apply MUSTER tank mix to Polish varieties of canola as crop injury may result. • LONTREL is recommended for use ONLY on the following cultivars: Cyclone, Ebony, Jewel, 46A65 and Hyola 401. •Add VENTURE to the tank first and agitate before adding LONTREL, add TURBOCHARGE adjuvant last.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
glyphosate ROUNDUP TRANSORB (360g/L)	0.297 to 0.45 kg/ha 0.825 to 1.25 L/ha	 0.33 to 0.5 L/ac	•FOR USE ONLY WITH PEDIGREED (CERTIFIED) CANOLA SEED DESIGNATED AS "ROUNDUP READY CANOLA". •Apply up to the 6 leaf stage of the canola. A second application may be made for later flushes emerging after the initial application and for improved results on perennial weeds. •The higher rate should be used when weeds are larger, when weed pressure is high and for perennial weeds.
imazethapyr PURSUIT (240g/L) plus non-ionic surfactant plus liquid fertilizer 10-34-0, 28-0-0 or 32-0-0	0.075 kg/ha 0.312 L/ha 0.25 % v/v 2 L/ha	 0.125 L/ac 0.25 % v/v 0.8 L/ac	•FOR USE ON IMAZETHAPYR TOLERANT CANOLA ONLY. •Apply early postemergence when the crop has at least one fully expanded leaf and before the weeds reach the 2 true leaf stage. •Imazethapyr will provide residual weed control from soil activity. •Some rotational cropping restrictions apply.
sethoxydim POAST ULTRA (450g/L) plus clopyralid LONTREL 360 (360g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 0.15 to 0.2 kg/ha 0.42 to 0.56 L/ha 0.75 to 1 L/ha	 0.13 to 0.19 L/ac 0.17 to 0.22 L/ac 0.3 to 0.4 L/ac	•Apply when canola is between the 2 to 6 leaf stage. •LONTREL is used on the following cultivars only: CYCLONE, EBONY, JEWEL, 46A65 and HYOLA 401. •Add 1/2 amount of water to tank, add the required amount of POAST ULTRA, then add the required amount of LONTREL. •Add MERGE last along with remaining amount of water to fill the tank.
sethoxydim POAST ULTRA (450g/L) plus ethametsulfuron-methyl MUSTER (75 DF) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 11 g/ha 15 g/ha 0.75 to 1 L/ha	 0.13 to 0.19 L/ac 6 g/ac 0.3 to 0.4 L/ac	•Apply when canola is between the 2 leaf stage and bolting. •Follow all label directions and precautions for the product you are tank mixing. •Add MUSTER to the tank first and agitate. •Once MUSTER is in suspension add the required amount of POAST ULTRA, followed by the correct amount of MERGE.
Preharvest			
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360 g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.9 kg/ha 2.5 L/ha 2.5 L/ha 0.83 kg/ha 2.5 L/ha	 1 L/ac 1 L/ac 1 L/ac	•apply in 50-100 L/ha (20-40 L/ac) water when the crop is at 30% grain moisture or less (consult label for visual indicators) •apply 7 to 14 days prior to harvest and use ground application only •DO NOT apply to seed crops
Harvest-Aid			
diquat REGLONE (200g/L) plus surfactant AGRAL 90 or AG-SURF	0.3 to 0.55 kg/ha 1.5 to 2.75 L/ha 0.1 % v/v	 0.6 to 1.1 L/ac 0.1 % v/v	•apply by air in at least 20 L/ha water (8 L/ac) when crop is 60-75% seed turn (green or brown)stage •combine no later than 14 days after herbicide application •for Argentine varieties, REGLONE should only be used to facilitate the harvest of a lodged crop •may be used on seed or commercial crops •DRIFT will injure adjacent crops or plants

Table 10. Canola Herbicide Weed Control Ratings

Weed control ratings are given as 0-9 where 0 indicates no control and 9 indicates 90%-100% control under ideal conditions.
Ratings are subjective values based on best available information and give general comparisons based on use as descibed in this guide.
Under unfavorable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.
Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used.
Ratings in **BOLD** suggest the weed is listed on the product label for control or suppression.
Please see product label for more information on registered weed species, product uses and precautions.

Treatment	Trade Name	Annual Grasses										Annual Broadleaves										Perennials						
		barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	wild oats	vol. corn	vol. wheat	vol. barley	buckwheat, wild	cocklebur	lady's thumb	lamb's-quarters	wild mustard	nightshades, annual	pigweed	ragweed	triazine tolerant	velvetleaf	field bindweed	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
soil applied grass herbicides																												
ethalfluralin	EDGE	**9**	**9**	**9**	**9**	**9**	8	**9**	?	**9**	**4**	**8**	2	**6**	**8**	2	**6**	**8**	2	8	2	6	2	2	2	2	2	2
trifluralin	TREFLAN, BONANZA or RIVAL	**9**	**9**	9	**9**	9	7	**8**	?	?	?	**5**	2	2	**8**	2	2	**8**	2	8	2	2	2	2	2	2	2	2
postemergence grass herbicides																												
clethodim	SELECT	**9**	**8**	**9**	**9**	**9**	**9**	?	?	?	?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**7**	0	0
diclofop-methyl	HOE-GRASS	**8**	**5**	**8**	**8**	**8**	3	**9**	**8**	?	?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
fenoxaprop-p-ethyl	EXCEL SUPER	**9**	**8**	**9**	**9**	**9**	**9**	?	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
fluazifop-p-butyl	VENTURE 25G	**9**	8	**9**	**8**	9	**8**	**9**	**9**	**9**	**9**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	0	0
quizalofop-p-ethyl	ASSURE II	**9**	8	9	**9**	9	9	?	**9**	**9**	**9**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	0	0
sethoxydim	POAST ULTRA	**9**	**8**	**9**	**9**	**9**	**9**	**8**	**8**	**7**	**7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**6**	0	0
postemergence broadleaf herbicides																												
clopyralid	LONTREL	0	0	0	0	0	0	0	0	0	0	**8**	?	3	5	0	?	5	8	?	?	3	?	?	0	0	**8**	**8**
ethametsulfuron-methyl	MUSTER	0	0	0	0	0	0	0	0	0	0	2	0	0	2	**9**	2	**8**	2	0	0	0	0	0	0	0	0	0
postemergence grass and broadleaf herbicides																												
glyphosate	ROUNDUP TRANSORB [1]	9	9	9	**9**	9	9	**9**	9	**9**	**9**	**8**	9	**8**	**9**	**9**	9	**9**	9	9	9	8	2	7/8	?	**9**	**8**	**8**
imazethapyr	PURSUIT [2]	**8**	7	7	**9**	8	7	8	?	?	?	8	7	9	**9**	9	**9**	**9**	**8**	**9**	**9**	2	2	2	4	5	2	2

? Insufficient information available to make a rating

[1] Use only on certified canola seed designated as "Roundup Ready" Canola.

[2] Use only on certified canola seed designated as "Pursuit Tolerant" Canola.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)

Corn, Field and Sweet

All treatments should be applied in 150 to 300 L/ha (60-120 L/ac) water unless otherwise specified.

Any single method of weed control or the continuous use of the same chemicals can lead to the build up of weeds resistant or tolerant to that control method. Triazine-resistant lamb's-quarters and pigweed have become a problem as a result of continuous corn and the repeated use of triazine herbicides. Rotation to other crops and/or other control methods will reduce the chance of new or unique weed infestations.

Blind harrowing with a set of light harrows operating at a shallow depth before the corn has emerged, or using a weeder harrow (with L shaped flexible tines) when the crop is 5-10 cm high can also help control small annual weed seedlings. High speed (10 kph), shallow (2.5-3cm) cultivation with the rotary hoe when corn is 7- 8 cm in height will help to control small weed seedlings. These techniques will not reduce herbicide action and may in some years enhance chemical weed control. Inter-row cultivation can be used to complement other weed control measures. Row cultivation is most effective when weeds are small. Cultivation should be shallow to reduce the germination of new weed seeds, to reduce moisture loss and to reduce corn root injury. Inter-row cultivation may be required when weeds escape herbicide treatment; weeds should be considered as escapes when they are 5- 7 cm high.

Band treatment of chemical over the row will reduce cost by one-half to two-thirds, depending on the row spacing and width of band. Shallow inter-row cultivation will be required to control weeds between the bands.

Cultivation will give some control of established perennial weeds but may also help to spread them to previously uninfested areas. Machinery sanitation is important when moving from one field to another. Many perennials (i.e. nutsedge) can be spread on tillage equipment. Custom operators should be particularly careful when moving from one farm to another

Sweet corn most frequently is grown in areas where the crops in sequence are very sensitive to atrazine residues. Avoid using atrazine rates above 1.1 kg/ha (active) (2.3 L/ha (0.92 L/ac) of 480 g/L) or 1.2 kg/ha (0.48 kg/ac) of (90 WG) product. (See notes on atrazine residues for suggestions).

SEED CORN RECOMMENDATIONS: Some field corn recommendations are applicable to seed corn, however, there are inbreds which are susceptible to some chemicals. Check with the contracting company before applying any herbicide.

For information on specific weeds see the Corn (Field and Sweet) Herbicide Weed Control Ratings Table and then refer to the appropriate section for details about herbicide treatment.

NITROGEN solution can be used as a carrier, instead of water, for preplant and preemergence application of some herbicides. Weed control activity is not increased. Spraying should be done before crop emergence. Consult the herbicide label as to the proper methods of application and use of dispersing agents. Calibrate the sprayer to apply the required amount of NITROGEN. Stainless steel flood jet nozzles of adequate size (e.g. Teejet TK SS 5 to TK SS 10) should be used. The NITROGEN solution is mildly corrosive, especially to brass, and the sprayer should be cleaned immediately after use. UNITE may be used as an aid in improving liquid fertilizer herbicide compatibility and stability when a simultaneous application of a liquid fertilizer and liquid or wettable powder herbicide is desired. Because formulations and rates vary, it is essential to read the label to determine the exact amount and method to be used. DO NOT apply with postemergence herbicides.

SPECIAL NOTES FOR CORN, FIELD AND SWEET

POSTEMERGENCE WITH 2,4-D, MCPA, MCPB, 2,4-DB, DICAMBA and KIL-MOR: 2,4-D, 2,4-DB, MCPA, dicamba, KIL-MOR and some mixtures are needed for control of such weeds as thistles, field bindweed, and triazine-resistant weeds.

Postemergence treatment with 2,4-D can be combined with cultural practices for the control of a wide range of weeds. After the crop is sown, use the rotary hoe, finger weeder, or light harrows to control weed seedlings until the corn is about 5 to 15 cm high (leaf extended). Then apply an overall spray of 2,4-D.

Some varieties of corn become increasingly susceptible to damage from 2,4-D beyond the 15 cm height (leaf extended) but if many broadleaf weeds are present in the rows, spraying is still recommended provided that drop pipes are used on the sprayer to direct the spray to the base of each corn plant, thus missing the corn leaves.

Do not cultivate until at least 2 weeks after 2,4-D spray treatment, and then only if necessary. Corn is often brittle for a period of time after spraying and may be damaged by equipment. Cultivation may also damage the shallow feeding roots of corn, as well as bringing ungerminated weed seeds to the ground surface. Following a period of drought, avoid 2,4-D application for at least a week after a good rain or irrigation.

The recommended 2,4-D treatments will control the top growth and reduce the competition of the more common broadleaved perennial weeds.

2,4-DB and mixtures of MCPB and MCPA (15:1) can be used on corn at higher rates than 2,4-D and therefore will give better control of Canada thistle, sow-thistle, field bindweed and wild buckwheat. These materials should be applied when the corn is 30-60 cm high, using drop pipes. Spot treatment is often possible.

Dicamba, dicamba + 2,4-D tank mix or KIL-MOR provide good control of such difficult weeds as field bindweed and Canada thistle. Drop pipes should be used when Canada thistle is in the bud stage and field bindweed is at the early flowering stage.

PRECAUTIONS: DO NOT use 2,4-D, MCPA, MCPB, 2,4-DB, dicamba, or KIL-MOR later than 2 weeks prior to the first appearance of tassels or ear silk. Extreme care must be used when applying these herbicides near susceptible crops because of possible herbicide movement. Soybeans, tomatoes and tobacco are extremely sensitive to dicamba and KIL-MOR and injury symptoms may persist for several weeks. DO NOT use dicamba in the area of susceptible crops when temperatures exceed 25°C on the day of application or if high humidity is expected, due to the possibility of dicamba volatilizing and injuring susceptible crops nearby. Several rows of corn should be left unsprayed when adjacent to soybean fields or other susceptible crops (use precautions on back cover).

TRIAZINE-RESISTANT ANNUAL WEEDS: Strains of lamb's-quarters, pigweed, ragweed and old witch grass have been found that are resistant to high rates of all TRIAZINE herbicides including atrazine, cyanazine and simazine. These triazine-resistant species have been found in corn growing areas across Ontario. These strains cannot be visibly distinguished from the susceptible strains. Preemergence treatment with dicamba or linuron or postemergence treatment with bentazon, bromoxynil, 2,4-D, dicamba, KIL-MOR or directed linuron will usually give control of the broadleaf species (see appropriate sections above). The grasses can be controlled with EPTC+, or metolachlor (see sections above.).

NOTES ON ATRAZINE AND SIMAZINE SOIL RESIDUES: Atrazine and simazine residues may last for more than one year, particularly if high rates are used more than once and dry weather occurs. If atrazine or simazine is used year after year as in a continuous corn program, triazine residues may be higher. Atrazine when used at rates from 1.2 to 1.5 kg/ha (active) (2.4 to 3.0 L/ha (0.96-1.2 L/ac) of (500 g/L) or 1.2 to 1.7 kg/ha (0.48-0.68 kg/ac) of (90 WG) PRODUCT) on corn generally has not caused injury on succeeding crops of oats, barley, mixed grains, or soybeans, except in years where there was very little rain the previous fall which would slow down atrazine degradation in the soil. Postemergence treatments may persist longer than preemergence treatments. Variations from this generality of 1.2 to 1.5 kg/ha atrazine may occur across the province.

Injury has been reported on tomatoes, white beans, forage seedings, peas, tobacco, cucumbers, onions, and turnips following applications of atrazine at more than 1.1 kg/ha (active)(2.3 L/ha (0.96 L/ac) of (480 g/L) or 1.2 kg/ha (0.48 kg/ac) of (90 WG) PRODUCT) on corn the previous year.

To reduce the hazard of atrazine residues on succeeding crops:

1. Apply the early postemergence atrazine oil-water treatment with the lower rate of atrazine: 1.1. kg/ha (active) (2.2 L/ha (0.88 L/ac) of (500gL) or 1.2 kg/ha (0.48 kg/ac) of (90 WG) PRODUCT). With this lower rate, a lower measure of weed control may result and cultivation may be necessary.

2. Fall plowing will reduce TRIAZINE injury more than will spring plowing.

3. Mold board plowing will disperse herbicide residue to a greater soil depth than chisel plowing, thus reducing the concentration of herbicide in the upper soil area.

4. Ensure that the sprayer used is adequate and is properly calibrated and adjusted. Spray uniformly without overlaps and do not spray while the sprayer is stopped.

If a residue problem is anticipated, contact your local Extension Personnel for information on soil analysis procedures for triazine residues.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
Refer to the "conservation tillage section" for information on treatments specific for use in conservation tillage systems, no-till, minimum-till, ridge-till.			
dimethenamid FRONTIER (900g/L) plus glyphosate ROUNDUP (356g/L)	1 to 1.25 kg/ha 1.1 to 1.4 L/ha 0.89 kg/ha 2.5 L/ha	 0.44 to 0.56 L/ac 1 L/ac	Use the higher rate of dimethenamid for heavier weed populations. Follow with sequential postemergence herbicide for additional broadleaf weed control.
dimethenamid FRONTIER (900g/L) plus glyphosate ROUNDUP (356g/L) plus atrazine AATREX NINE-O (90WG)	1 to 1.25 kg/ha 1.1 to 1.4 L/ha 0.89 kg/ha 2.5 L/ha 1 to 1.53 kg/ha 1.11 to 1.7 kg/ha	 0.44 to 0.56 L/ac 1 L/ac 0.44 to 0.68 kg/ac	Use the higher rate of dimethenamid for heavier weed populations. Control of non-emerged triazine resistant weeds will be limited to pigweed
dimethenamid FRONTIER (900g/L) plus glyphosate ROUNDUP (356g/L) plus dicamba BANVEL II (480g/L)	1 to 1.25 kg/ha 1.1 to 1.4 L/ha 0.89 kg/ha 2.5 L/ha 0.6 kg/ha 1.25 L/ha	 0.44 to 0.56 L/ac 1 L/ac 0.5 L/ac	Use the higher rate of dimethenamid for heavier weed populations.
dimethenamid FRONTIER (900g/L) plus glyphosate ROUNDUP (356g/L) plus dicamba/ atrazine MARKSMAN ((1:2)401g/L)	1 to 1.25 kg/ha 1.1 to 1.4 L/ha 0.89 kg/ha 2.5 L/ha 1.8 kg/ha 4.5 L/ha	 0.44 to 0.56 L/ac 1 L/ac 1.8 L/ac	Use the higher rate of dimethenamid for heavier weed populations.
glyphosate ROUNDUP (356g/L) plus s-metolachlor/benoxacor DUAL II MAGNUM (915g/L) and plus atrazine AATREX NINE-O (90WG) or plus s-metolachlor/benoxacor/ atrazine PRIMEXTRA II MAGNUM ((1:0.8)720g/L)	0.836 to 0.89 kg/ha 2.35 to 2.5 L/ha 1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 1 to 1.53 kg/ha 1.11 to 1.7 kg/ha 2.16 to 2.88 kg/ha 3 to 4 L/ha in 200 L water/ha	 0.94 to 1 L/ac 0.5 to 0.7 L/ac 0.44 to 0.68 kg/ac 1.2 to 1.6 L/ac in 80 L water/ac	Use the higher rate of s-metolachlor/benoxacor for heavier weed populations. Use higher rate of glyphosate when perennial weeds are present. Many broadleaf perennial weeds may not be controlled at this time and rate of application.

metolachlor DUAL (960g/L) plus cyanazine BLADEX 90 DF (90 DF)	1.92 to 2.64 kg/ha 2 to 2.75 L/ha 1.8 to 2.25 kg/ha 2 to 2.5 kg/ha	 0.8 to 1.1 L/ac 0.8 to 1 kg/ac	Apply pre-plant burndown application only when emerged weeds are less than 6 cm tall. If emerged annual weeds are taller than 6 cm apply glyphosate prior to the tank mix application. For improved burndown of small emerged annual weeds, the following additives may be applied: Crop oil 28-0-0 or 10-34-0 at 5% volume/volume; Crop oil concentrate at 1% volume/volume; Non-ionic surfactant at 0.1% volume/volume. Use higher rates of metolachlor for heavier weed populations.
metolachlor DUAL (960g/L) plus glyphosate TMS TOUCHDOWN 480 (330g/L)	1.92 to 2.64 kg/ha 2 to 2.75 L/ha 0.77 to 0.83 kg/ha 2.35 to 2.5 L/ha	 0.8 to 1.1 L/ac 0.94 to 1 L/ac	Use the higher rate of metolachlor for heavier weed populations. Use higher rate of glyphosate TMS when perennial weeds are present.
paraquat GRAMOXONE (200g/L) plus atrazine AATREX NINE-O (90WG) AATREX (480g/L) ATRAZINE 480 (480g/L)	0.55 to 1.1 kg/ha 2.75 to 5.5 L/ha 1.53 kg/ha 1.7 kg/ha 3.18 L/ha 3.18 L/ha in 325 to 500 L/ha water	 1.1 to 2.2 L/ac 0.68 kg/ac 1.27 L/ac 1.27 L/ac in 130 to 200 L/ac water	Apply at least 3 days prior to crop emergence. Some perennial species may escape (alfalfa, bromegrass and orchard grass). Consideration should be given to follow up treatments when the corn is at the approximate stage of growth with herbicide treatments recommended for use in the conventional tillage corn section.
s-metolachlor/benoxacor DUAL II MAGNUM (915g/L) plus atrazine AATREX NINE-O (90WG)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 1 to 1.53 kg/ha 1.11 to 1.7 kg/ha	 0.5 to 0.7 L/ac 0.44 to 0.68 kg/ac	Apply pre-plant burndown application only when emerged weeds are less than 6 cm tall. If emerged annual weeds are taller than 6 cm apply glyphosate prior to the tank mix application or make an application of 3-way tank mix of s-metolachlor/benoxacor plus atrazine plus glyphosate. For improved burndown to small emerged annual weeds, the following additives may be applied: Crop oil, 28-0-0 or 10-34-0 at 5% volume/volume; Crop oil concentrate at 1 % volume/volume; Non-ionic surfactant at 0.1% volume/volume. Use higher rates for heavier weed populations.
s-metolachlor/benoxacor DUAL II MAGNUM (915g/L) plus glyphosate ROUNDUP (356g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 0.836 to 0.89 kg/ha 2.35 to 2.5 L/ha in 200 L/ha water	 0.5 to 0.7 L/ac 0.94 to 1 L/ac in 80 L/ac water	Use the higher rate of s-metolachlor/benoxacor for heavier weed populations. Use higher rate of glyphosate when perennial weeds are present.
dimethenamid FRONTIER (900g/L)	1 to 1.25 kg/ha 1.1 to 1.4 L/ha	 0.44 to 0.56 L/ac	Apply PPI or PRE. Incorporation equipment should be set to work soil no deeper than 10 cm. Control of yellow nutsedge is obtained when FRONTIER is applied PPI. Minimum PPI rate is 1.125 kg/ha. Use the higher rate of FRONTIER for the control of nightshade and pigweed. DO NOT use on muck, peat, or high organic matter soils. See tank mixes for treatments to provide annual broadleaf control or follow with sequential postemergence broadleaf herbicide. DO NOT USE ON SEED CORN OR POPCORN.
EPTC/ R25788 (EPTC+) ERADICANE (800g/L)	3.4 to 4.4 kg/ha 4.25 to 5.5 L/ha	 1.7 to 2.2 L/ac	Must be preplant incorporated. See "Notes on Chemicals". DO NOT USE ON SEED CORN.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
EPTC/ R25788 (EPTC+) ERADICANE (800g/L) plus metolachlor DUAL (960g/L)	2.4 kg/ha 3 L/ha 0.72 kg/ha 0.75 L/ha	 1.2 L/ac 0.3 L/ac	Must be preplant incorporated. See "Notes on Chemicals". DO NOT USE ON SEED CORN.
s-metolachlor/benoxacor DUAL II MAGNUM (915g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha	 0.5 to 0.7 L/ac	Apply PPI or PRE. Incorporation equipment should be set to work soil no deeper than 10 cm. Control of yellow nutsedge is obtained when DUAL II MAGNUM is applied PPI. Optimal control of nightshade is obtained when DUAL II MAGNUM is applied PRE. DO NOT use on muck, peat, or high organic matter soils. See tank mixes for treatments to provide annual broadleaf control or follow with sequential postemergence broadleaf herbicide.
atrazine ATRAZINE 480 (480g/L) AATREX NINE-O (90WG)	1.01 to 1.49 kg/ha 2.1 to 3.1 L/ha 1.12 to 1.65 kg/ha	 0.84 to 1.24 L/ac 0.45 to 0.66 kg/ac	Apply PRE. Weeds will normally emerge and die within a few days; atrazine can persist for varying lengths of time; longer under dry, cool weather and coarse textured soils. See tank mixes for reducing rates and avoiding residues, and for treatments to provide annual grass control.
atrazine ATRAZINE 480 (480g/L) AATREX NINE-O (90WG) plus dicamba BANVEL II (480g/L) or dicamba/atrazine MARKSMAN ((1:2)401g/L)	1.01 to 1.49 kg/ha 2.1 to 3.1 L/ha 1.12 to 1.65 kg/ha 0.6 kg/ha 1.25 L/ha 1.8 kg/ha 4.5 L/ha	 0.84 to 1.24 L/ac 0.45 to 0.66 kg/ac 0.5 L/ac 1.8 L/ac	Apply PRE. This treatment should provide good control of triazine resistant broadleaf weeds and velvetleaf. See notes on atrazine with respect to residues. DO NOT APPLY TO SAND OR SANDY LOAM SOILS OR USE ON SEED OR SWEET CORN. See precautions for BANVEL II applied alone.
dicamba BANVEL II (480g/L)	0.6 kg/ha 1.25 L/ha	 0.5 L/ac	Apply PRE as a broadcast ground treatment to corn seed planted 4 cm or more deep before weeds and corn emerge. If corn seed is less than 4 cm below the soil surface, delay application of BANVEL II until the spike stage of corn. Apply to medium to fine textured soils containing more than 2.5% organic matter. DO NOT use on sandy or sandy loam soils. DO NOT incorporate.
flumetsulam/clopyralid FIELDSTAR ((1:2.7) 85.6WG)	185 g/ha 216 g/ha	 86 g/ac	May be applied up to 15 days before planting PPI or PRE. When incorporated set equipment to uniformly work soil at a depth of 5 to 8.5 cm. Sufficient rainfall to moisten the soil to a depth of 5 cm is necessary to move FIELDSTAR into the weed germination zone. DO NOT use on soils with pH greater than 7.8 or less than 5.9. DO NOT use on soils with less than 2% organic matter. DO NOT apply to corn treated with a granular organophosphate insecticide. DO NOT USE ON SWEET CORN, SEED CORN OR POPCORN.
simazine PRINCEP NINE-T (90WG) or simazine SIMADEX (500g/L) SIMAZINE 480 (480g/L)	1.35 to 2.25 kg/ha 1.5 to 2.5 kg/ha 1.6 to 4 kg/ha 3.2 to 8 L/ha 3.4 to 8.3 L/ha	 0.6 to 1 kg/ac 1.28 to 3.2 L/ac 1.36 to 3.32 L/ac	Apply PRE. These products are listed separately because of their widely differing rate ranges. In both cases the low rates should be used on sandy soils while the higher rates may be used on loams and clays. Full season annual weed control can be expected except for crabgrass of fall panicum where infestations have built up. Caution is advised when considering rates beyond 2.0 kg/ha (0.8 kg/ac) as soil residues may be high. Read "Notes on atrazine and simazine soil residue" at the start of the corn section.

cyanazine	2.25 to 2.7 kg/ha		Apply PRE. Barnyard grass and redroot pigweed may escape. Use the low rate on coarse textured soils and on sweet corn. Cyanazine is not recommended alone for fine textured or muck soils. See other treatments for appropriate tank mixes.
BLADEX 90 DF (90 DF)	2.5 to 3 kg/ha	1 to 1.2 kg/ac	
cyanazine	2.11 to 2.64 kg/ha		Apply PPI at these rates. This combination will improve barnyard grass and pigweed control over cyanazine alone. Use the lower rate of both cyanazine and atrazine on coarse textured soils and the higher rates on medium to fine textured soils. DO NOT use on muck or peat soils. Mid season (July) germinating fall panicum may not be controlled.
BLADEX 90 DF (90 DF)	2.35 to 3 kg/ha	0.94 to 1.2 kg/ac	
BLADEX LIQUID (480g/L)	4.4 to 5.5 L/ha	1.76 to 2.2 L/ac	
plus atrazine	1.128 to 1.3 kg/ha		
ATRAZINE 480 (480g/L)	2.35 to 2.7 L/ha	0.94 to 1.08 L/ac	
AATREX NINE-O (90WG)	1.25 to 1.44 kg/ha	0.5 to 0.58 kg/ac	
cyanazine	1.8 to 2.25 kg/ha		Apply PRE. The tank mix of cyanazine plus atrazine will improve control on fine textured soils and control of barnyard grass and redroot pigweed. DO NOT use the mixture on muck or peat soils. Fall panicum or velvetleaf may not be controlled for the full season.
BLADEX 90 DF (90 DF)	2 to 2.5 kg/ha	0.8 to 1 kg/ac	
plus atrazine	1.2 to 1.49 kg/ha		
ATRAZINE 480 (480g/L)	2.5 to 3.1 L/ha	1 to 1.24 L/ac	
AATREX NINE-O (90WG)	1.35 to 1.65 kg/ha	0.54 to 0.66 kg/ac	
cyanazine	2.25 kg/ha		Apply PRE. Treatment provides effective control of annual broadleaf and grass weeds including triazine resistant broadleaves. The addition of atrazine will improve control on fine textured soils and control of barnyard grass and redroot pigweed. DO NOT USE ON SEED OR SWEET CORN. DO NOT use on sand or sandy loam soils.
BLADEX LIQUID (480g/L)	4.75 L/ha	1.9 L/ac	
BLADEX 90 DF (90 DF)	2.5 kg/ha	1 kg/ac	
plus atrazine	1.082 kg/ha		
AATREX (480g/L)	2.25 L/ha	0.9 L/ac	
AATREX NINE-O (90WG)	1.2 kg/ha	0.48 kg/ac	
ATRAZINE 480 (480g/L)	2.25 L/ha	0.9 L/ac	
plus dicamba	0.6 kg/ha		
BANVEL II (480g/L)	1.25 L/ha	0.5 L/ac	
cyanazine	2.25 to 2.7 kg/ha		Apply PRE. Barnyard grass may not be adequately controlled. Use higher rates on fine soils and heavy weed infestations. DO NOT INCORPORATE THIS TANK MIX OR USE ON SAND OR SANDY LOAM SOILS OR ON SEED OR SWEET CORN. Cyanazine and dicamba are short lived and will disappear before the end of the season. Dicamba controls velvetleaf, and triazine (atrazine, cyanazine or simazine) resistant broadleaf weeds. See precautions for cyanazine and dicamba alone.
BLADEX LIQUID (480g/L)	4.75 to 5.5 L/ha	1.9 to 2.2 L/ac	
BLADEX 90 DF (90 DF)	2.5 to 3 kg/ha	1 to 1.2 kg/ac	
plus dicamba	0.6 kg/ha		
BANVEL II (480g/L)	1.25 L/ha	0.5 L/ac	
dimethenamid	1 to 1.25 kg/ha		Apply PREPLANT. Use the higher rate of dimethenamid for heavier weed populations. Control of non-emerged triazine resistant weeds will be limited to pigweed. For improved burndown control the addition of glyphosate may be required.
FRONTIER (900g/L)	1.1 to 1.4 L/ha	0.44 to 0.56 L/ac	
plus atrazine	1 to 1.53 kg/ha		
AATREX NINE-O (90WG)	1.11 to 1.7 kg/ha	0.44 to 0.68 kg/ac	
dimethenamid	1 to 1.25 kg/ha		Apply PPI or PRE. The minimum rate of FRONTIER for the PPI application is 1.25 L/ha (0.5 L/ac). Triazine resistant pigweed will be suppressed. DO NOT USE ON CORN GROWN FOR SEED, POPCORN OR SWEET CORN.
FRONTIER (900g/L)	1.1 to 1.4 L/ha	0.44 to 0.56 L/ac	
plus atrazine	1.5 kg/ha		
ATRAZINE 480 (480g/L)	3.12 L/ha	1.25 L/ac	
AATREX NINE-O (90WG)	1.67 kg/ha	0.67 kg/ac	
or plus cyanazine	2.7 kg/ha		
BLADEX LIQUID (480g/L)	5.5 L/ha	2.2 L/ac	
BLADEX 90 DF (90 DF)	3 kg/ha	1.2 kg/ac	

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
dimethenamid	1 to 1.25 kg/ha		Apply PREPLANT. Use the higher rate of dimethenamid for heavier weed populations. For improved burndown control the addition of glyphosate may be required. See precautions for BANVEL II applied alone.
FRONTIER (900g/L)	1.1 to 1.4 L/ha	0.44 to 0.56 L/ac	
plus dicamba	0.6 kg/ha		
BANVEL II (480g/L)	1.25 L/ha	0.5 L/ac	
dimethenamid	1 to 1.25 kg/ha		Apply PRE. DO NOT use these tank mixes on sandy soils. DO NOT USE ON SEED CORN, POPCORN OR SWEET CORN. See precautions for BANVEL II applied alone.
FRONTIER (900g/L)	1.1 to 1.4 L/ha	0.44 to 0.56 L/ac	
plus dicamba	0.6 kg/ha		
BANVEL II (480g/L)	1.25 L/ha	0.5 L/ac	
or plus dicamba/ atrazine	1.8 kg/ha		
MARKSMAN ((1:2)401g/L)	4.5 L/ha	1.8 L/ac	
dimethenamid	1 to 1.25 kg/ha		Apply PREPLANT. Use the higher rate of dimethenamid for heavier weed populations. For improved burndown control the addition of glyphosate may be required. See precautions for BANVEL II applied alone.
FRONTIER (900g/L)	1.1 to 1.4 L/ha	0.44 to 0.56 L/ac	
plus dicamba/ atrazine	1.8 kg/ha		
MARKSMAN ((1:2)401g/L)	4.5 L/ha	1.8 L/ac	
EPTC/ R25788 (EPTC+)	3.4 to 6.8 kg/ha		Apply PPI. For suppression of moderate to heavy infestations of wild proso millet, use the higher rate of EPTC+ with atrazine. For most effective suppression of proso millet delay treatment and planting until mid to late May. Cultivation or a directed post application of linuron may be required to control later emerging proso millet. DO NOT USE ON SEED CORN.
ERADICANE (800g/L)	4.25 to 8.5 L/ha	1.7 to 3.4 L/ac	
plus atrazine	1.2 to 1.49 kg/ha		
ATRAZINE 480 (480g/L)	2.5 to 3.1 L/ha	1 to 1.24 L/ac	
AATREX NINE-O (90WG)	1.35 to 1.65 kg/ha	0.54 to 0.66 kg/ac	
EPTC/ R25788 (EPTC+)	6.8 kg/ha		Apply PPI. For increased control of proso millet, an inter-row cultivation should be used. DO NOT USE ON SEED CORN.
ERADICANE (800g/L)	8.5 L/ha	3.4 L/ac	
plus cyanazine	2 to 2.25 kg/ha		
BLADEX LIQUID (480g/L)	4.25 to 4.7 L/ha	1.7 to 1.9 L/ac	
BLADEX 90 DF (90 DF)	2.25 to 2.5 kg/ha	0.9 to 1 kg/ac	
EPTC/ R25788 (EPTC+)	1.7 to 3.4 kg/ha		Apply PPI. Note that this is a reduced rate of metribuzin. This tank mix provides improved velvetleaf control but will not control proso millet, triazine resistant weeds or cocklebur. DO NOT USE ON SEED OR SWEET CORN.
ERADICANE (800g/L)	2.13 to 4.25 L/ha	0.85 to 1.7 L/ac	
plus metribuzin	0.3 kg/ha		
SENCOR 500 F (500g/L)	0.6 L/ha	0.24 L/ac	
SENCOR 75 DF (75 WG)	0.4 kg/ha	0.16 kg/ac	
flumetsulam/clopyralid	185 g/ha		May be applied PREPLANT up to 15 days before planting, PPI or PRE. DO NOT move treated soil out of the row or move untreated soil to the surface during minimum or no-till planting or weed control will be diminished. When incorporated set equipment to uniformly work soil at a depth of 5 to 8.5 cm. Sufficient rainfall to moisten the soil to a depth of 5 cm is necessary to move PRE FIELDSTAR into the weed germination zone. DO NOT use on soils with pH greater than 7.8 or less than 5.9. DO NOT use on soils with less than 2% organic matter. DO NOT apply to corn treated with a granular organophosphate insecticide. DO NOT APPLY TO SWEET CORN, SEED CORN OR POPCORN.
FIELDSTAR ((1:2.7) 85.6WG)	216 g/ha	86 g/ac	
plus s-metolachlor/benoxacor	1.14 to 1.6 kg/ha		
DUAL II MAGNUM (915g/L)	1.25 to 1.75 L/ha	0.5 to 0.7 L/ac	

flumetsulam/clopyralid FIELDSTAR ((1:2.7) 85.6 WG) plus dimethenamid FRONTIER (900g/L)	185 g/ha 216 g/ha 1 to 1.125 kg/ha 1.1 to 1.25 L/ha	 86 g/ac 0.44 to 0.5 L/ac	Apply PRE. See precautions for FIELDSTAR or FRONTIER used alone. DO NOT APPLY TO SWEET CORN, SEED CORN or POPCORN.
flumetsulam/clopyralid FIELDSTAR ((1:2.7) 85.6WG) plus EPTC/ R25788 (EPTC+) ERADICANE (800g/L)	185 g/ha 216 g/ha 3.4 to 4.4 kg/ha 4.25 to 5.5 L/ha	 86 g/ac 1.7 to 2.2 L/ac	May be applied up to 15 days before planting but must be uniformly incorporated with equipment set to work at a depth of 5 to 8.5 cm. DO NOT use on soils with less than 2% organic matter. DO NOT use on soils with pH greater than 7.8 or less than 5.9. DO NOT apply to corn treated with a granular organophosphate insecticide. DO NOT APPLY TO SWEET CORN, SEED CORN OR POPCORN.
flumetsulam/clopyralid FIELDSTAR ((1:2.7) 85.6WG) plus pendimethalin PROWL 400 (400g/L)	185 g/ha 216 g/ha 1.68 kg/ha 4.2 L/ha	 86 g/ac 1.68 L/ac	Apply PRE. Sufficient rainfall to moisten the soil to a depth of 5 cm is necessary to move FIELDSTAR into the weed germination zone. DO NOT use on soils with pH greater than 7.8 or less than 5.9. DO NOT use on soils with less than 2% organic matter. DO NOT apply to corn treated with a granular organophosphate insecticide. DO NOT APPLY TO SWEET CORN, SEED CORN OR POPCORN.
flumetsulam/clopyralid FIELDSTAR ((1:2.7) 85.6WG) plus s-metolachlor/benoxacor/ atrazine PRIMEXTRA II MAGNUM ((1:0.8)720g/L)	185 g/ha 216 g/ha 2.38 kg/ha 3.3 L/ha	 86 g/ac 1.34 L/ac	May be applied up to 15 days before planting, PPI or PRE. DO NOT move treated soil out of the row or move untreated soil to the surface during minimum or no-till planting or weed control will be diminished. When incorporated set equipment to uniformly work soil at a depth of 5 to 8.5 cm. Sufficient rainfall to moisten the soil to a depth of 5 cm is necessary to move PRE FIELDSTAR into the weed germination zone. DO NOT use on soils with pH greater than 7.8 or less than 5.9. DO NOT use on soils with less than 2% organic matter. DO NOT apply to corn treated with a granular organophosphate insecticide. DO NOT APPLY TO SWEET CORN, SEED CORN OR POPCORN. When incorporated, PRIMEXTRA II MAGNUM will control nutsedge for most of the season (10-14 weeks): mid season (July) germinating fall panicum may not be controlled.
imazethapyr PURSUIT (240g/L)	0.075 kg/ha 0.312 L/ha	 0.125 L/ac	Apply PPI or PRE. Use on imazethapyr tolerant "CLEARFIELD" corn ONLY. Tank mixing with another herbicide is recommended as a good weed management practice.
imazethapyr PURSUIT (240g/L) plus atrazine ATRAZINE 480 (480g/L) AATREX NINE-O (90WG)	0.075 kg/ha 0.312 L/ha 1 to 1.5 kg/ha 2.08 to 3.12 L/ha 1.11 to 1.67 kg/ha	 0.125 L/ac 0.83 to 1.25 L/ac 0.44 to 0.67 kg/ac	Apply PPI or PRE. Use on imazethapyr tolerant "CLEARFIELD" corn ONLY.
imazethapyr PURSUIT (240g/L) plus cyanazine BLADEX LIQUID (480g/L) BLADEX 90 DF (90 DF)	0.075 kg/ha 0.312 L/ha 1.8 to 2.7 kg/ha 3.75 to 5.5 L/ha 2 to 3 kg/ha	 0.125 L/ac 1.5 to 2.2 L/ac 0.8 to 1.2 kg/ac	Apply PPI or PRE. A maximum rate of 2.25 kg ai/ha of cyanazine is allowed PRE. Use on imazethapyr tolerant "CLEARFIELD" corn ONLY.
imazethapyr PURSUIT (240g/L) plus dicamba BANVEL II (480g/L)	0.075 kg/ha 0.312 L/ha 0.6 kg/ha 1.25 L/ha	 0.125 L/ac 0.5 L/ac	Apply PRE. Use on imazethapyr tolerant "CLEARFIELD" corn ONLY.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
imazethapyr PURSUIT (240g/L) plus metolachlor DUAL (960g/L)	0.075 kg/ha 0.312 L/ha 1.9 to 2.6 kg/ha 2 to 2.7 L/ha	 0.125 L/ac 0.8 to 1.1 L/ac	Apply PPI. Use on imazethapyr tolerant "CLEARFIELD" corn ONLY.
imazethapyr PURSUIT (240g/L) plus pendimethalin PROWL 400 (400g/L)	0.075 kg/ha 0.312 L/ha 1.68 kg/ha 4.2 L/ha	 0.125 L/ac 1.68 L/ac	Apply PRE. Use on imazethapyr tolerant "CLEARFIELD" corn ONLY.
linuron AFOLAN F (480g/L)	1.803 to 2.26 kg/ha 3.75 to 4.7 L/ha	 1.5 to 1.88 L/ac	Apply PRE. Annual grasses, ragweed and velvetleaf are partially controlled but are the first to escape, particularly if low rates of the herbicide are used. DO NOT use on sandy soils. Seed corn at least 4 cm deep. Heavy rainfall and adverse weather conditions may result in temporary crop injury. See label and notes on sweet corn for information for use on sweet corn.
linuron LOROX DF (50 DF) or linuron LINURON 480 (480g/L) plus atrazine ATRAZINE 480 (480g/L) AATREX NINE-O (90WG)	1.082 kg/ha 2.2 kg/ha 1.08 to 1.56 kg/ha 2.25 to 3.25 L/ha 1.1 kg/ha 2.29 L/ha 1.22 kg/ha	 0.88 kg/ac 0.9 to 1.3 L/ac 0.92 L/ac 0.49 kg/ac	Apply PRE. Use this tank mix only on clay or clay loam soil to avoid injury. This tank mix controls annual weeds including triazine resistant redroot pigweed and lamb's-quarters and is a method of reducing atrazine residues. Annual grasses will be the first weeds to escape. See precautions for linuron alone.
metolachlor DUAL (960g/L) plus cyanazine BLADEX LIQUID (480g/L) BLADEX 90 DF (90 DF)	1.92 to 2.64 kg/ha 2 to 2.75 L/ha 1.8 to 2.7 kg/ha 3.75 to 5.5 L/ha 2 to 3 kg/ha	 0.8 to 1.1 L/ac 1.5 to 2.2 L/ac 0.8 to 1.2 kg/ac	Apply PPI or PRE. The maximum rate for preemergence application of cyanazine is 2.25 kg ai/ha. Metolachlor controls the grasses and cyanazine controls the broadleaf weeds. Use the high rates of cyanazine for heavy weed infestations or on fine textured soils. The PPI treatment will give control of proso millet. The PRE treatment may not control fall panicum all season long. See comments at beginning about mixing fertilizers.
metribuzin SENCOR 500 F (500g/L) SENCOR 75 DF (75 WG) plus atrazine ATRAZINE 480 (480g/L) ATRAZINE 90W (90WP) plus metolachlor DUAL (960g/L)	0.3 to 0.5 kg/ha 0.6 to 1 L/ha 0.4 to 0.67 kg/ha 1.1 kg/ha 2.29 L/ha 1.22 kg/ha 1.68 kg/ha 1.75 L/ha	 0.24 to 0.4 L/ac 0.16 to 0.27 kg/ac 0.92 L/ac 0.49 kg/ac 0.7 L/ac	Apply PPI or PRE. Incorporation should be even and shallow in the top 5 cm of soil. Use the high rate of metribuzin if heavy velvetleaf pressure is expected. Apply as a broadcast treatment and shallow incorporate thoroughly into the top 5 cm of soil prior to planting. Seed should be planted at least 4 cm deep. Use only on medium or heavy soils. Heavy rainfall and adverse growing conditions may result in temporary crop injury. See SENCOR label for a list of corn hybrids previously tested for metribuzin tolerance. DO NOT USE ON SEED OR SWEET CORN.
pendimethalin PROWL 400 (400g/L)	1.68 kg/ha 4.2 L/ha	 1.68 L/ac	Apply PRE. Pendimethalin alone will not control emerged weeds. Tank mixing or use of a sequential herbicide program to achieve broad spectrum control is recommended. Plant corn at least 4 cm deep and ensure good seed coverage. Pendimethalin maybe applied in water or liquid fertilizer (rate of 200 L liquid fertilizer/ha (80 L liquid fertilizer/ac)). A liquid fertilizer compatibility test is recommended with any of the registered pendimethalin tank mix combinations. If rain is not received within 7 days, rotary hoeing or shallow cultivation is required. DO NOT USE ON SWEET OR SEED CORN.

pendimethalin	1.68 kg/ha		Apply PRE. See precautions for PROWL alone. DO NOT USE ON SWEET OR SEED CORN.
PROWL 400 (400g/L)	4.2 L/ha	1.68 L/ac	
plus atrazine	1.53 kg/ha		
ATRAZINE 90W (90WP)	1.7 kg/ha	0.68 kg/ac	
AATREX NINE-O (90WG)	1.7 kg/ha	0.68 kg/ac	
pendimethalin	1.68 kg/ha		Apply PRE. See precautions for PROWL alone. DO NOT USE ON SWEET OR SEED CORN.
PROWL 400 (400g/L)	4.2 L/ha	1.68 L/ac	
plus cyanazine	2.25 kg/ha		
BLADEX 90 DF (90 DF)	2.5 kg/ha	1 kg/ac	
pendimethalin	1.68 kg/ha		Apply PRE. See precautions for PROWL alone and BANVEL II alone. DO NOT USE ON SWEET OR SEED CORN.
PROWL 400 (400g/L)	4.2 L/ha	1.68 L/ac	
plus dicamba	0.6 kg/ha		
BANVEL II (480g/L)	1.25 L/ha	0.5 L/ac	
pendimethalin	1.68 kg/ha		Apply PRE. See precautions for PROWL alone and BANVEL II alone. DO NOT USE ON SWEET OR SEED CORN.
PROWL 400 (400g/L)	4.2 L/ha	1.68 L/ac	
plus dicamba/atrazine	1.48 to 1.8 kg/ha		
MARKSMAN ((1:2)401g/L)	3.7 to 4.5 L/ha	1.5 to 1.8 L/ac	
s-metolachlor/benoxacor	1.14 to 1.6 kg/ha		Apply PPI or PRE. S-metolachlor/benoxacor controls the grasses and atrazine controls the broadleaf weeds. When incorporated, s-metolachlor/benoxacor will control nutsedge for most of the season (10-14 weeks): mid season (July) germinating fall panicum may not be controlled. The high rate should be used where annual grass build up or nutsedge infestation is evident. The PPI application may not give full season control of fall panicum or velvetleaf.
DUAL II MAGNUM (915g/L)	1.25 to 1.75 L/ha	0.5 to 0.7 L/ac	
plus atrazine	1.01 to 1.49 kg/ha		
ATRAZINE 480 (480g/L)	2.1 to 3.1 L/ha	0.84 to 1.24 L/ac	
AATREX NINE-O (90WG)	1.12 to 1.65 kg/ha	0.45 to 0.66 kg/ac	
or s-metolachlor/benoxacor/ atrazine	2.16 to 2.88 kg/ha		
PRIMEXTRA II MAGNUM ((1:0.8)720g/L)	3 to 4 L/ha	1.2 to 1.6 L/ac	
s-metolachlor/benoxacor	1.14 to 1.6 kg/ha		Apply PRE. DO NOT USE THIS TANK MIX ON SAND OR SANDY SOIL OR ON SEED OR SWEET CORN. High rates should be used on heavy grass infestations and for fall panicum. Fall panicum may not be controlled all season. Dicamba controls velvetleaf, and triazine (atrazine, cyanazine or simazine) resistant broadleaf weeds. See precautions for BANVEL II alone.
DUAL II MAGNUM (915g/L)	1.25 to 1.75 L/ha	0.5 to 0.7 L/ac	
plus dicamba	0.6 kg/ha		
BANVEL II (480g/L)	1.25 L/ha	0.5 L/ac	
s-metolachlor/benoxacor	1.14 to 1.6 kg/ha		Apply PRE. DO NOT USE THIS TANK MIX ON SAND OR SANDY SOIL OR ON SEED OR SWEET CORN. High rates should be used on heavy grass infestations and for fall panicum. Fall panicum may not be controlled all season. Dicamba controls velvetleaf, and triazine (atrazine, cyanazine or simazine) resistant broadleaf weeds. See precautions for BANVEL II alone.
DUAL II MAGNUM (915g/L)	1.25 to 1.75 L/ha	0.5 to 0.7 L/ac	
plus dicamba	0.6 kg/ha		
BANVEL II (480g/L)	1.25 L/ha	0.5 L/ac	
plus atrazine	1.01 to 1.49 kg/ha		
ATRAZINE 480 (480g/L)	2.1 to 3.1 L/ha	0.84 to 1.24 L/ac	
AATREX NINE-O (90WG)	1.12 to 1.65 kg/ha	0.45 to 0.66 kg/ac	

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
s-metolachlor/benoxacor DUAL II MAGNUM (915g/L) plus dicamba/atrazine MARKSMAN ((1:2)401g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 1.48 to 1.8 kg/ha 3.7 to 4.5 L/ha	 0.5 to 0.7 L/ac 1.5 to 1.8 L/ac	Apply PRE. DO NOT USE THIS TANK ON SAND OR SANDY SOIL OR ON SEED OR SWEET CORN. High rates should be used on heavy grass infestations and for fall panicum. Fall panicum may not be controlled all season. Dicamba controls velvetleaf, and triazine (atrazine, cyanazine or simazine) resistant broadleaf weeds. See precautions for BANVEL II alone.
s-metolachlor/benoxacor/ atrazine PRIMEXTRA II MAGNUM ((1:0.8)720g/L) plus dicamba BANVEL II (480g/L)	2.16 to 2.88 kg/ha 3 to 4 L/ha 0.6 kg/ha 1.25 L/ha	 1.2 to 1.6 L/ac 0.5 L/ac	Apply PRE. DO NOT USE THIS TANK ON SAND OR SANDY SOIL OR ON SEED OR SWEET CORN. High rates should be used on heavy grass infestations and for fall panicum. Fall panicum may not be controlled all season. Dicamba controls velvetleaf, and triazine (atrazine, cyanazine or simazine) resistant broadleaf weeds. See precautions for BANVEL II alone.
s-metolachlor/benoxacor/ atrazine PRIMEXTRA II MAGNUM ((1:0.8)720g/L) plus linuron AFOLAN F (480g/L) LOROX DF (50 DF) LINURON 480 (480g/L)	2.16 to 2.88 kg/ha 3 to 4 L/ha 0.375 to 0.75 kg/ha 0.78 to 1.56 L/ha 0.76 to 1.5 kg/ha 0.8 to 1.56 L/ha	 1.2 to 1.6 L/ac 0.31 to 0.62 L/ac 0.3 to 0.6 kg/ac 0.32 to 0.62 L/ac	Apply PRE. This tank mix can be used on light textured soils with OM greater than 1.0%. DO NOT USE ON SEED OR SWEET CORN. Linuron controls triazine resistant lamb's-quarters and redroot pigweed. Fall panicum or velvetleaf may not be controlled for the full season.
simazine PRINCEP NINE-T (90WG) or simazine SIMADEX (500g/L) SIMAZINE 480 (480g/L) SIMAZINE 80W (80 WP)	1.35 to 2.25 kg/ha 1.5 to 2.5 kg/ha 1.6 to 4 kg/ha 3.2 to 8 L/ha 3.4 to 8.3 L/ha 2 to 2.75 kg/ha	 0.6 to 1 kg/ac 1.28 to 3.2 L/ac 1.36 to 3.32 L/ac 0.8 to 1.1 kg/ac	Apply PPI or PRE. These products are listed separately because of their widely differing rate ranges. In both cases the low rates should be used on sandy soils while the higher rates may be used on loams and clays. Full season annual weed control can be expected except for crabgrass or fall panicum where infestations have built up. Caution is advised when considering rates beyond 2.0 kg/ha (0.8 kg/ac) as soil residues may be high. Read "Notes on atrazine and simazine soil residues" at the start of the corn section. NOTE: Maximum registered Simazine 80W rate is 2.75 kg/ha (1.1 kg/ac) (2.2 kg/ha active).
Postemergence Grass Herbicides			
dimethenamid FRONTIER (900g/L)	1 to 1.25 kg/ha 1.1 to 1.4 L/ha	 0.44 to 0.56 L/ac	Annual grasses should not be beyond the 2 leaf stage and corn should be at the spike to 3 leaf stage. Tank mix with atrazine, cyanazine, dicamba or dicamba/atrazine or follow with sequential later postemergence herbicide for additional broadleaf weed control. DO NOT add oil or surfactants. DO NOT USE ON SEED CORN, POPCORN OR SWEET CORN.
nicosulfuron ACCENT (75 DF) plus non-ionic surfactant CITOWETT PLUS, AGRAL 90 or AG-SURF	25 g/ha 33 g/ha 0.2 % v/v 2L/1000 L	 13 g/ac 0.2 % v/v 2L/1000 L	Always add water soluble packages to clean water with the agitator running. Corn should be within the 1 to 8 leaf stage of growth. Apply nicosulfuron when annual grasses are in the 1 to 6 leaf stage and/or quackgrass is in the 3 to 6 leaf stage (10 to 20 cm). DO NOT APPLY TO SEED CORN. DO NOT apply nicosulfuron to corn treated with organophosphorus insecticides. SWEET CORN - . Corn should be in the 1 to 6 leaf stage (4 visible collars). USE ONLY on these cultivars: Bonus BT, GSS 7831, CNS 710, Krispy King, GH 2690. DO NOT apply on Delmonte 2038.

nicosulfuron/rimsulfuron ULTIM ((1:1)37.4 DF) plus non-ionic surfactant	25 g/ha 67 g/ha 0.2 % v/v	 27 g/ac 0.2 % v/v	Apply one water soluble bag/ha of nicosulfuron/rimsulfuron (ULTIM). Always add water soluble packages to clean water with the agitator running. Corn should be within the 1-6 leaf stage (30 cm). Apply nicosulfuron/rimsulfuron when annual grasses are in the 1-6 leaf stage, and/or quackgrass is in the 3-6 leaf stage (10-20 cm). DO NOT apply nicosulfuron/rimsulfuron to corn treated with organophosphorous insecticides. DO NOT USE ON SWEET OR SEED CORN.
rimsulfuron ELIM EP (25 DF) plus a non-ionic surfactant	15 g/ha 60 g/ha 0.2 % v/v	 24 g/ac 0.2 % v/v	Always add water soluble packages to clean water with the agitator running. Corn should be within the spike-3 leaf stage (20 cm). Apply rimsulfuron when annual grasses are in the 1-4 leaf stage. DO NOT apply rimsulfuron to corn treated with organophosphorous insecticides. DO NOT APPLY TO SWEET OR SEED CORN.
s-metolachlor/benoxacor DUAL II MAGNUM (915g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha	 0.5 to 0.7 L/ac	Corn should be at the spike to 2 leaf stage and annual grasses not beyond 2 leaf stage. DO NOT add oil or surfactants.
sethoxydim POAST ULTRA (450g/L) plus oil concentrate ASSIST	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac	FOR USE ON SETHOXYDIM RESISTANT (POAST PROTECTED) CORN ONLY. Apply to emerged grasses in the 1 to 5 leaf stage during active growth while crop is small enough to permit thorough spray coverage.
Postemergent Broadleaf Herbicides			
2,4-D * 2,4-D (470g/L)	0.282 to 0.564 kg/ha 0.6 to 1.2 L/ha	 0.24 to 0.48 L/ac	Apply as an overall spray until corn is 15 cm high (leaf extended); thereafter, use drop nozzles. use amine formulation. See special notes on postemergence use of 2,4-D and related hormone chemicals. DO NOT add oil or surfactant. DO NOT USE ON SEED OR SWEET CORN.
2,4-D/ dicamba/ mecoprop KIL-MOR (485g/L)	0.413 to 0.534 kg/ha 0.85 to 1.1 L/ha	 0.34 to 0.44 L/ac	Apply an overall spray until corn is 15 cm high (leaf extended): thereafter use drop nozzles. Jerusalem artichoke (30-40 cm in height) can be controlled with 2 sprays (10-14 days apart) per season for 2 seasons (see specific label instructions). DO NOT add oil or surfactant. See special notes on postemergence use of dicamba and related hormone chemicals. DO NOT USE ON SEED OR SWEET CORN.
2,4-DB CALIBER 400 (400g/L) COBUTOX 600 (600g/L) EMBUTOX 625 (625g/L)	1.1 to 1.5 kg/ha 2.75 to 3.75 L/ha 1.66 to 2.5 L/ha 1.75 to 2.25 L/ha	 1.1 to 1.5 L/ac 0.66 to 1 L/ac 0.7 to 0.9 L/ac	See precautions for MCPB/MCPA and special notes on postemergence use of 2,4-DB and related hormone chemicals. DO NOT add oil or surfactant. 2,4-DB will not control field horsetail. DO NOT USE ON SEED OR SWEET CORN. NOTE: The maximum label rate for EMBUTOX 625 is 2.25 L/ha (0.9 L/ac) of product.
atrazine AATREX (480g/L) AATREX NINE-O (90WG) ATRAZINE 480 (480g/L) plus 2,4-D/ dicamba/ mecoprop KIL-MOR (485g/L)	1.01 to 1.49 kg/ha 2.1 to 3.1 L/ha 1.12 to 1.65 kg/ha 2.1 to 3.1 L/ha 0.413 kg/ha 0.85 L/ha	 0.84 to 1.24 L/ac 0.45 to 0.66 kg/ac 0.84 to 1.24 L/ac 0.34 L/ac	Apply as an overall spray until corn is 10 cm high (leaf extended) and before broadleaf weeds reach 10 cm in height. DO NOT APPLY TO SWEET OR SEED CORN. DO NOT add oil or surfactant. See special notes on postemergence use of dicamba and related hormone chemicals.

Active ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
atrazine	1.01 to 1.49 kg/ha		This treatment will provide good to excellent control of broadleaf weeds including those triazine resistant and velvetleaf. DO NOT USE ON SWEET OR SEED CORN. See special notes for corn regarding dicamba applications and precautions for BANVEL II alone POST. Use the higher rate for residual control.
ATRAZINE 480 (480g/L)	2.1 to 3.1 L/ha	0.84 to 1.24 L/ac	
AATREX NINE-O (90WG)	1.12 to 1.65 kg/ha	0.45 to 0.66 kg/ac	
plus dicamba	0.288 kg/ha		
BANVEL II (480g/L)	0.6 L/ha	0.24 L/ac	
atrazine	1.01 kg/ha		This combination can be applied as a sequential treatment with a preemergent grass herbicide or in fields without grass infestation. Only escaping grasses up to the 3 leaf stage are suppressed with this combination.
ATRAZINE 480 (480g/L)	2.1 L/ha	0.84 L/ac	
AATREX NINE-O (90WG)	1.12 kg/ha	0.45 kg/ac	
plus pyridate	0.45 kg/ha		
LENTAGRAN (45 WP)	1 kg/ha	0.4 kg/ac	
atrazine	1.01 to 1.49 kg/ha		For increased activity and extended period of activity, apply in an oil water emulsion of 10 to 17 L/ha (4-6.8 L/ac) of emulsifiable light mineral oil and 150 to 200 L/ha water (60-80 L/ac). Apply when most weeds have emerged. The low rate can be used successfully with later cultivation.
ATRAZINE 480 (480g/L)	2.1 to 3.1 L/ha	0.84 to 1.24 L/ac	
ATRAZINE 90W (90WP)	1.12 to 1.65 kg/ha	0.45 to 0.66 kg/ac	
plus oil	10 to 17 L/ha	4 to 6.8 L/ac	
atrazine/2,4-D	0.936 to 1.404 kg/ha		Apply as an overall spray from the spike to the 4 leaf stage of corn. DO NOT add oil or surfactant. DO NOT USE ON SWEET OR SEED CORN.
SHOTGUN (390g/L)	2.4 to 3.59 L/ha	0.96 to 1.44 L/ac	
bentazon	0.841 to 1.082 kg/ha		No adjuvant is required to be used with BASAGRAN FORTE. Reduce oil concentrate to 1 L/ha (0.4 L/ac) under hot, humid weather conditions. Control is best when the broadleaves are small and actively growing. Grasses are NOT controlled. Top growth of nutsedge and Canada thistle are controlled and field bindweed may be suppressed by 2 applications of 1.75 L/ha (0.7 L/ac) (0.84 kg active/ha) applied 10 days apart. Cool weather or drought may delay control.
BASAGRAN FORTE (480g/L)	1.75 to 2.25 L/ha	0.7 to 0.9 L/ac	
or			
BASAGRAN (480g/L)	1.75 to 2.25 L/ha	0.7 to 0.9 L/ac	
plus oil concentrate			
ASSIST	2.L/ha	0.8 L/ac	
bentazon/ atrazine	0.8 to 1.6 kg/ha		The recommended rate of 1.2 to 1.6 kg/ha of bentazon/atrazine (3 to 4 L/ha (1.2 to 1.6 L/ac) LADDOK) may be reduced to 0.8 to 1 kg/ha (2 to 2.5 L/ha (0.8 to 1 L/ac) LADDOK) if metolachlor has been applied at the recommended rate for preemergence grass control. Use LADDOK at 3 to 4 L/ha (1.2 to 1.6 L/ac) for nutsedge control; repeat 7 to 10 days if necessary. Can be applied safely to all types and varieties of corn at any growth stage.
LADDOK ((1:1)400g/L)	2 to 4 L/ha	0.8 to 1.6 L/ac	
plus oil concentrate			
ASSIST	2 L/ha	0.8 L/ac	
bromoxynil	0.28 to 0.336 kg/ha		Controls most annual broadleaf weeds, including triazine resistant species at the 1 to 4 leaf stage. Bromoxynil is a contact herbicide and is non volatile.
PARDNER (280g/L)	1 to 1.2 L/ha	0.4 to 0.48 L/ac	
bromoxynil	0.28 kg/ha		Controls a wider spectrum of broadleaf weeds than bromoxynil alone; larger pigweed, ragweed and velvetleaf will be controlled. Apply from the 4 to 8 leaf stage of corn. DO NOT add oil or surfactant. DO NOT use formulated atrazine/oil products in this tank mixture. A reduced rate of atrazine at 0.5 kg/ha (1/2 the low rate) can be used to control weeds listed for bromoxynil alone plus ragweed up to the 8 leaf stage, velvetleaf and triazine susceptible red root pigweed up to 6 leaves.
PARDNER (280g/L)	1 L/ha	0.4 L/ac	
plus atrazine	1.01 to 1.49 kg/ha		
AATREX (480g/L)	2.1 to 3.1 L/ha	0.84 to 1.24 L/ac	
AATREX NINE-O (90WG)	1.12 to 1.65 kg/ha	0.45 to 0.66 kg/ac	
bromoxynil	0.28 kg/ha		Controls most annual broadleaf weeds including triazine resistant lamb's-quarters, pigweed and ragweed up to the 6 leaf stage. Apply when the corn is in the 4 to 6 leaf stage as an overall treatment and up to 50 cm standing corn, using drop pipes. DO NOT USE ON SWEET OR SEED CORN. See special notes on postemergence use of dicamba and precautions for BANVEL II alone POST.
PARDNER (280g/L)	1 L/ha	0.4 L/ac	
plus dicamba	0.144 kg/ha		
BANVEL II (480g/L)	0.3 L/ha	0.12 L/ac	

bromoxynil/ MCPA BUCTRIL M ((1:1)560g/L)	0.558 kg/ha 1 L/ha	 0.4 L/ac	Controls most annual broadleaf weeds up to the 4 leaf stage (lamb's-quarters and mustards to 8 leaf stage). Use in preference to bromoxynil when wild mustard is a particular problem. Apply from the 4 to 6 leaf stage of corn but not after the 6 leaf stage. DO NOT USE ON SEED OR SWEET CORN.
bromoxynil/ MCPA BUCTRIL M ((1:1)560g/L) plus atrazine ATRAZINE 480 (480g/L) AATREX NINE-O (90WG)	0.56 kg/ha 1 L/ha 1.1 to 1.49 kg/ha 2.29 to 3.1 L/ha 1.22 to 1.65 kg/ha	 0.4 L/ac 0.96 to 1.24 L/ac 0.49 to 0.66 kg/ac	Controls a wider spectrum of broadleaf weeds than bromoxynil/MCPA alone; larger velvetleaf will be controlled. Apply from the 4 to 6 leaf stage of corn but not after the 6 leaf stage. DO NOT add oil or surfactant. DO NOT use formulated atrazine/oil products in this tank mixture. DO NOT USE ON SEED OR SWEET CORN.
dicamba BANVEL II (480g/L)	0.288 to 0.6 kg/ha 0.6 to 1.25 L/ha	 0.24 to 0.5 L/ac	Application of the lower rate can be made up to 20 cm standing corn. Drop pipes should be used when corn is 20 cm to 50 cm tall. The 0.6 kg/ha rate commonly referred to as the overlay treatment is particularly effective in controlling velvetleaf and providing extended residual control of other late germinating deep rooted broadleaf annuals and can be applied from the spike stage to the 5 leaf stage (13 cm standing corn).DO NOT USE ON SEED OR SWEET CORN or add oil or surfactant. See special notes on postemergence use of dicamba and related hormone chemicals. DO NOT use dicamba if temperature exceeds 25°C at the time of application, or if high humidity is expected, due to the possibility of dicamba volatilizing and injury to susceptible crops nearby. See precautions in SPECIAL NOTES ON CORN.
dicamba BANVEL II (480g/L) plus 2,4-D 2,4-D (470g/L)	0.14 kg/ha 0.29 L/ha 0.4 kg/ha 0.85 L/ha	 0.12 L/ac 0.34 L/ac	Application can be made up to 10 cm standing corn. Drop pipes should be used when corn is 10 cm to 50 cm tall. DO NOT USE ON SEED OR SWEET CORN, or add oil or surfactant. Use amine formulation of 2,4-D. See special notes on postemergence use of dicamba and 2,4-D and related hormone chemicals. See precautions in SPECIAL NOTES ON CORN and for BANVEL II alone POST.
dicamba/atrazine MARKSMAN ((1:2)401g/L)	1.48 to 1.8 kg/ha 3.7 to 4.5 L/ha	 1.5 to 1.8 L/ac	Application can be made up to 13 cm standing corn (5 leaf). Use the lower rate on coarse textured soils and the higher rate on medium to fine textured soils. See special notes on postemergence use of dicamba and related hormone chemicals. DO NOT APPLY TO SWEET OR SEED CORN. See precautions in SPECIAL NOTES ON CORN and for BANVEL II alone POST.
diflufenzopyr/dicamba DISTINCT (70 WG) plus non-ionic surfactant plus liquid urea ammonium nitrate (UAN)	0.2 kg/ha 0.285 kg/ha 0.25 % v/v 1.25 % v/v	 0.115 kg/ac 0.25 % v/v 1.25 % v/v	Apply to actively growing weeds when corn is in the 2-leaf to 6-leaf stage. DO NOT USE ON SEED OR SWEET CORN.
flumetsulam/clopyralid FIELDSTAR ((1:2.7) 85.6WG) plus non ionic surfactant	185 g/ha 216 g/ha 0.25 % v/v	 86 g/ac 0.25 % v/v	Apply up to the 2 leaf stage of corn when broadleaf weeds are at the cotyledon to 2 leaf stage of growth. Sufficient rainfall to moisten the soil to a depth of 5 cm is necessary to move flumetsulam/clopyralid into the weed germination zone to control those not yet emerged. DO NOT use on soils with less than 2% 0.M or a pH greater than 7.8 or less than 5.9. DO NOT apply to corn treated with a granular organophosphate insecticide. DO NOT APPLY TO SWEET CORN, SEED CORN OR POPCORN.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
flumetsulam/clopyralid/2,4-D STRIKER ((1:2.7:5.4)84.3WG) plus non-ionic surfactant	236 g/ha 280 g/ha 0.25 % v/v	 112 g/ac 0.25 % v/v	Under dry growing conditions, use 28-0-0 or 32-0-0 liquid fertilizer (2.5% v/v, or 25 L per 1000 L or spray solution) together with non-ionic surfactant to provide enhanced control. Apply up to the 6 leaf stage of corn when the majority of broadleaf weeds are at the 2 to 4 leaf stage of growth. DO NOT apply to corn treated with a granular organophosphate insecticide. DO NOT apply when air temperature is near freezing or when freezing conditions are expected for several days following application. DO NOT USE ON SWEET CORN, SEED CORN OR POPCORN.
MCPA MCPA AMINE (500g/L)	0.38 to 0.63 kg/ha 0.76 to 1.26 L/ha	 0.3 to 0.5 L/ac	Controls triazine resistant and most other broadleaf weeds. Treat before the corn reaches 15 cm tall (leaf extended). Use the lower rate for small, actively growing weeds and the higher rate for larger weeds or under adverse weather conditions. Top growth of fully developed HORSETAIL (15-25 cm) can be controlled with 1 L/ha (0.4 L/ac) of product; a directed late post application using drop nozzles to avoid corn injury is necessary. DO NOT USE ON SEED OR SWEET CORN.
MCPB/MCPA (15:1) TROPOTOX PLUS (400g/L) CLOVITOX PLUS (400g/L)	1.1 to 1.7 kg/ha 2.75 to 4.25 L/ha 2.75 to 4.25 L/ha	 1.1 to 1.7 L/ac 1.1 to 1.7 L/ac	Apply when corn is 30 to 60 cm high, using drop pipes. See special notes on postemergence use of MCPB/MCPA and related hormone chemicals. DO NOT add oil or surfactant. Some control of field horsetail may be obtained with the higher rates of MCPB/MCPA. DO NOT USE ON SEED OR SWEET CORN.
prosulfuron + dicamba PEAKPLUS (PEAK (75WG) + BANVEL II (480g/L)) plus non-ionic surfactant	10 g/ha + 13.3 g/ha 0.14 kg/ha + 0.3 L/ha 0.2 % v/v	 5.3 g/ac + 0.12 L/ac 0.2 % v/v	AVAILABLE ONLY as a co-pack called PEAKPLUS to be applied with a non-ionic surfactant. Controls most annual broadleaf weeds including triazine resistant lamb's-quarters and pigweed up to the 6 leaf stage; cocklebur and velvetleaf up to the 6 leaf stage; and ragweed up to the 8 leaf stage. Apply when the corn is in the 2 to 7 leaf stage. DO NOT apply to corn treated with organophosphorus insecticides. DO NOT APPLY TO SWEET, SEED CORN OR POPCORN.
Annual Grass and Broadleaf Herbicides			
cyanazine BLADEX 90 DF (90 DF)	2.25 kg/ha 2.5 kg/ha	 1 kg/ac	Use only the dry flowable formulation, as the suspension may cause corn burning. DO NOT add oil or surfactants. DO NOT treat corn beyond the 3 leaf stage. Corn injury may occur during cold weather and under flooding conditions.
cyanazine BLADEX 90 DF (90 DF) plus atrazine ATRAZINE 480 (480g/L) AATREX (480g/L) AATREX NINE-O (90WG) plus dicamba BANVEL II (480g/L)	1.8 to 2.25 kg/ha 2 to 2.5 kg/ha 1.1 kg/ha 2,29 L/ha 2,29 L/ha 1,22 kg/ha 0.288 kg/ha 0.6 L/ha	 0.8 to 1 kg/ac 0.92 L/ac 0.92 L/ac 0.49 kg/ac 0.24 L ac	Use only the dry flowable formulation of cyanazine. The addition of atrazine will improve control of barnyard grass and pigweeds. Excellent control of annual grasses can be obtained if not beyond the 2 leaf stage at application. DO NOT USE ON SEED OR SWEET CORN, add oil or surfactant, or treat corn beyond 3 leaf stage.
cyanazine BLADEX 90 DF (90 DF) plus atrazine ATRAZINE 480 (480g/L) ATRAZINE 90W (90WP) AATREX NINE-O (90WG)	1.8 to 2.25 kg/ha 2 to 2.5 kg/ha 1.1 kg/ha 2.25 L/ha 1.22 kg/ha 1.22 kg/ha	 0.8 to 1 kg/ac 0.92 L/ac 0.49 kg/ac 0.49 kg/ac	Use only the dry flowable formulation of cyanazine. Excellent control of annual weeds can be obtained if applied before grasses reach the 2 leaf stage. Use the low rate on coarse textured soils. DO NOT treat corn beyond the 3 leaf stage. Use this triazine mixture where barnyard grass may be a problem. DO NOT add oil or surfactants. Corn injury may occur during cold weather and under flooding conditions.

cyanazine	2.25 kg/ha		Use only the dry flowable formulation of cyanazine. Excellent control of annual weeds can be obtained if applied before grasses reach the 2 leaf stage. Dicamba will control velvetleaf and triazine resistant broadleaf annual weeds. DO NOT USE ON SEED OR SWEET CORN. DO NOT add oil or surfactant. DO NOT treat field corn beyond the 3 leaf stage.
BLADEX 90 DF (90 DF)	2.5 kg/ha	1 kg/ac	
plus dicamba	0.288 kg/ha		
BANVEL II (480g/L)	0.6 L/ha	0.24 L/ac	
diflufenzopyr/dicamba	0.2 kg/ha		Apply to actively growing weeds when corn is in the 2-leaf to 3-leaf stage. Annual grasses should not be beyond the 2-leaf stage. DO NOT USE ON SEED OR SWEET CORN.
DISTINCT (70 WG)	0.285 kg/ha	0.115 kg/ac	
plus dimethenamid	1.125 kg/ha		
FRONTIER (900g/L)	1.25 L/ha	0.5 L/ac	
plus non-ionic surfactant	0.25 % v/v	0.25 % v/v	
plus liquid urea ammonium nitrate (UAN)	1.25 % v/v	1.25 % v/v	
diflufenzopyr/dicamba	0.2 kg/ha		Apply to active growth stage of seedling broadleaf weeds (less than 5 cm tall). Apply to annual grasses in the 1 to 6 leaf stage and to quackgrass in the 3 to 6 leaf stage (10 to 20 cm). DO NOT USE ON SEED OR SWEET CORN.
DISTINCT (70 WG)	0.285 kg/ha	0.115 kg/ac	
plus nicosulfuron	25 g/ha		
ACCENT (75 DF)	33 g/ha	13 g/ac	
plus non-ionic surfactant	0.25 % v/v	0.25 % v/v	
plus liquid urea ammonium nitrate (UAN)	1.25 % v/v	1.25 % v/v	
diflufenzopyr/dicamba	0.2 kg/ha		Apply to active growth stage of seedling broadleaf weeds (less than 5 cm tall). Apply to annual grasses in the 1 to 6 leaf stage and to quackgrass in the 3 to 6 leaf stage (10 to 20 cm). DO NOT USE ON SEED OR SWEET CORN.
DISTINCT (70 WG)	0.285 kg/ha	0.115 kg/ac	
plus nicosulfuron/rimsulfuron	25 g/ha		
ULTIM ((1:1)37.4 DF)	67 g/ha	27 g/ac	
plus non-ionic surfactant	0.25 % v/v	0.25 % v/v	
plus liquid urea ammonium nitrate (UAN)	1.25 % v/v	1.25 % v/v	
dimethenamid	1 to 1.25 kg/ha		Use only the dry flowable formulation of cyanazine. DO NOT add oil or surfactants. Corn should be at the spike to 2 leaf stage and grasses should not be beyond the 2 leaf stage. Triazine resistant pigweed will be controlled. DO NOT USE ON SEED CORN, POPCORN OR SWEET CORN.
FRONTIER (900g/L)	1.1 to 1.4 L/ha	0.44 to 0.56 L/ac	
plus atrazine	1.5 kg/ha		
ATRAZINE 480 (480g/L)	3.12 L/ha	1.25 L/ac	
AATREX NINE-O (90WG)	1.67 kg/ha	0.67 kg/ac	
or plus cyanazine	2.25 kg/ha		
BLADEX 90 DF (90 DF)	2.5 kg/ha	1 kg/ac	
dimethenamid	1 to 1.25 kg/ha		Application can be made when the corn is in the spike to 2 leaf stage and annual grasses are not beyond the 2 leaf stage. DO NOT use these tank mixes on sandy soils or on sweet corn. See special notes on postemergence use of dicamba and related hormone chemicals and precautions for BANVEL II alone POST. DO NOT USE ON SEED CORN, POPCORN OR SWEET CORN.
FRONTIER (900g/L)	1.1 to 1.4 L/ha	0.44 to 0.56 L/ac	
plus dicamba	0.6 kg/ha		
BANVEL II (480g/L)	1.25 L/ha	0.5 L/ac	
or plus dicamba/atrazine	1.8 kg/ha		
MARKSMAN ((1:2)401g/L)	4.5 L/ha	1.8 L/ac	

Active ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
flumetsulam/clopyralid FIELDSTAR ((1:2.7) 85.6WG) plus s-metolachlor/benoxacor/atrazine PRIMEXTRA II MAGNUM ((1:0.8)720g/L)	185 g/ha 216 g/ha 2.38 kg/ha 3.3 L/ha	 86 g/ac 1.34 L/ac	Apply up to the 2 leaf stage of corn when broadleaf weeds are at the cotyledon to 2 leaf stage and annual grasses are at a maximum of 2 leaf. Sufficient rainfall to moisten the soil to a depth of 5 cm is necessary to move FIELDSTAR into the weed germination zone to control those not yet emerged. DO NOT use on soils with pH greater than 7.8 or less than 5.9. DO NOT use on soils with less than 2% organic matter. DO NOT apply to corn treated with a granular organophosphate insecticide. DO NOT APPLY TO SWEET CORN, SEED CORN OR POPCORN.
glufosinate ammonium LIBERTY 200 SN (200g/L)	0.3 to 0.5 kg/ha 1.5 to 2.5 L/ha	 0.6 to 1 L/ac	FOR USE ONLY ON FIELD AND SEED CORN SPECIALLY DEVELOPED TO BE TOLERANT TO LIBERTY 200 SN. LIBERTY 200 SN is a contact herbicide and has no residual activity. Consult the product label for rate recommendations for specific weeds and weed stages. Ammonium sulphate can be applied at 6 L/ha (2.4 L/ac)(liquid) or 3.3 kg/ha (1.3 kg/ac)(dry) for improved control of specific weeds. DO NOT add oil or any other surfactants. LIBERTY 200 SN can be applied from the 1 to 8 leaf stage of corn.
glufosinate ammonium LIBERTY 200 SN (200g/L) plus atrazine ATRAZINE 480 (480g/L) AATREX NINE-O (90WG)	0.3 to 0.5 kg/ha 1.5 to 2.5 L/ha 0.84 to 1.12 kg/ha 1.75 to 2.34 L/ha 0.94 to 1.24 kg/ha	 0.6 to 1 L/ac 0.7 to 0.93 L/ac 0.37 to 0.5 kg/ac	FOR USE ONLY ON FIELD AND SEED CORN SPECIALLY DEVELOPED TO BE TOLERANT TO LIBERTY 200 SN. This tank mix can be applied up to the 8 leaf stage of corn.
glufosinate ammonium LIBERTY 200 SN (200g/L) plus dicamba BANVEL II (480g/L)	0.3 to 0.5 kg/ha 1.5 to 2.5 L/ha 0.3 kg/ha 0.625 L/ha	 0.6 to 1 L/ac 0.25 L/ac	FOR USE ONLY ON FIELD CORN SPECIALLY DEVELOPED TO BE TOLERANT TO LIBERTY 200 SN. This tank mix can be applied up to the 8 leaf stage of corn. See precautions for BANVEL II alone POST.
glufosinate ammonium LIBERTY 200 SN (200g/L) plus dicamba/atrazine MARKSMAN ((1:2)401g/L)	0.3 to 0.5 kg/ha 1.5 to 2.5 L/ha 1 to 1.5 kg/ha 2.5 to 3.7 L/ha	 0.6 to 1 L/ac 1 to 1.5 L/ac	FOR USE ONLY ON FIELD CORN SPECIALLY DEVELOPED TO BE TOLERANT TO LIBERTY 200 SN. This tank mix can be applied up to the 5 leaf stage of corn. See precautions for BANVEL II alone POST.
glufosinate ammonium LIBERTY 200SN (200g/L) followed by glufosinate ammonium LIBERTY 200SN (200g/L)	0.4 kg/ha 2 L/ha 0.25 kg/ha 1.25 L/ha	 0.8 L/ac 0.5 L/ac	FOR USE ONLY ON FIELD CORN SPECIALLY DEVELOPED TO BE TOLERANT TO LIBERTY 200 SN. The first application may be applied on 4 to 5 leaf corn at the proper growth stage of the weeds. The second application may be made up to the 8 leaf stage of corn to control subsequent flushes of weeds.
glufosinate ammonium LIBERTY 200SN (200g/L) plus pendimethalin PROWL 400 (400g/L)	0.3 to 0.5 kg/ha 1.5 to 2.5 L/ha 1 kg/ha 2.5 L/ha	 0.6 to 1 L/ac 1 L/ac	FOR USE ONLY ON FIELD CORN SPECIALLY DEVELOPED TO BE TOLERANT TO LIBERTY 200 SN. This tank mix can be applied up to the 4 leaf stage of corn.
glyphosate ROUNDUP TRANSORB (360g/L)	0.9 kg/ha 2.5 L/ha	 1 L/ac	FOR USE ONLY WITH PEDIGREED (CERTIFIED) CORN SEED DESIGNATED AS "ROUNDUP READY CORN". Apply up to and including the 8 leaf stage of corn. The initial application is recommended between the 2 to 6 leaf stage (3-5 leaf is optimum timing) to remove early competition. A second application may be applied up to the 8 leaf stage of corn (8 leaf fully expanded). Use 100-200 L/ha (40-80 L/ac) of water.

imazethapyr	0.075 kg/ha		Use on imazethapyr tolerant "CLEARFIELD" corn ONLY. Apply when the weeds are up to the 4 true leaf stage. Imazethapyr will provide residual weed control from soil activity. Some rotational cropping restrictions apply (see "Notes on Chemicals").
PURSUIT (240g/L)	0.312 L/ha	0.125 L/ac	
plus atrazine	1 to 1.5 kg/ha		
ATRAZINE 480 (480g/L)	2.08 to 3.12 L/ha	0.83 to 1.25 L/ac	
AATREX NINE-O (90WG)	1.11 to 1.67 kg/ha	0.44 to 0.67 kg/ac	
or			
imazethapyr/atrazine	0.665 kg/ha		
PATRIOT ((1:8)405g/L)	1.64 L/ha	0.66 L/ac	
plus non-ionic surfactant	0.25 % v/v	0.25 % v/v	
plus liquid fertilizer			
28-0-0, 10-34-0, or 32-0-0	2 L/ha	0.8 L/ac	
imazethapyr	0.075 kg/ha		Use on imazethapyr tolerant "CLEARFIELD" corn ONLY. Apply when the weeds are up to the 2 true leaf stage. Imazethapyr will provide residual weed control from soil activity. Some rotational cropping restrictions apply (see "Notes on Chemicals").
PURSUIT (240g/L)	0.312 L/ha	0.125 L/ac	
plus cyanazine	1.8 to 2.25 kg/ha		
BLADEX LIQUID (480g/L)	3.75 to 4.75 L/ha	1.5 to 1.9 L/ac	
BLADEX 90 DF (90 DF)	2 to 2.5 kg/ha	0.8 to 1 kg/ac	
plus non-ionic surfactant	0.25 % v/v	0.25 % v/v	
plus liquid fertilizer			
28-0-0, 10-34-0, or 32-0-0	2 L/ha	0.8 L/ac	
imazethapyr	0.075 kg/ha		Use on imazethapyr tolerant "CLEARFIELD" corn ONLY. Apply when the weeds are up to the 4 true leaf stage. Imazethapyr will provide residual weed control from soil activity. Some rotational cropping restrictions apply (see "Notes on Chemicals"). See precautions for BANVEL II alone POST.
PURSUIT (240g/L)	0.312 L/ha	0.125 L/ac	
plus dicamba	0.288 to 0.6 kg/ha		
BANVEL II (480g/L)	0.6 to 1.25 L/ha	0.24 to 0.5 L/ac	
plus non-ionic surfactant	0.25 % v/v	0.25 % v/v	
plus liquid fertilizer			
28-0-0, 10-34-0, or 32-0-0	2 L/ha	0.8 L/ac	
imazethapyr	0.075 kg/ha		Use on imazethapyr tolerant "CLEARFIELD" corn ONLY. Apply when the weeds are up to the 4 true leaf stage. Imazethapyr will provide residual weed control from soil activity. Some rotational cropping restrictions apply (see "Notes on Chemicals"). See precautions for BANVEL II alone POST.
PURSUIT (240g/L)	0.312 L/ha	0.125 L/ac	
plus dicamba/atrazine	1.4 to 1.74 kg/ha		
MARKSMAN ((1:2)401g/L)	3.5 to 4.33 L/ha	1.4 to 1.73 L/ac	
plus non-ionic surfactant	0.25 % v/v	0.25 % v/v	
plus liquid fertilizer			
28-0-0, 10-34-0, or 32-0-0	2 L/ha	0.8 L/ac	
imazethapyr	0.075 kg/ha		Use on imazethapyr tolerant "CLEARFIELD" corn ONLY. Apply when the weeds are up to the 2 true leaf stage. Imazethapyr will provide residual weed control from soil activity. Some rotational cropping restrictions apply (see "Notes on Chemicals").
PURSUIT (240g/L)	0.312 L/ha	0.125 L/ac	
plus non-ionic surfactant	0.25 % v/v	0.25 % v/v	
plus liquid fertilizer			
28-0-0, 10-34-0, or 32-0-0	2 L/ha	0.8 L/ac	

Active Ingredient - TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT - PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
imazethapyr	0.075 kg/ha		Use on imazethapyr tolerant "CLEARFIELD" corn ONLY. Apply when the weeds are up to the 2 true leaf stage. Imazethapyr will provide residual weed control from soil activity. Some rotational cropping restrictions apply (see "Notes on Chemicals").
PURSUIT (240g/L)	0.312 L/ha	0.125 L/ac	
plus pendimethalin	1.68 kg/ha		
PROWL 400 (400g/L)	4.2 L/ha	1.68 L/ac	
plus non-ionic surfactant	0.25 % v/v	0.25 % v/v	
plus liquid fertilizer			
28-0-0, 10-34-0, or 32-0-0	2 L/ha	0.8 L/ac	
metolachlor	1.92 to 2.64 kg/ha		Use only the dry flowable formulation of cyanazine. Apply the tank mix when corn is spike to 2 leaf and annual grasses are not beyond the 2 leaf stage. DO NOT add oil or surfactants. Corn injury may occur during cold weather and under flooding conditions.
DUAL (960 g/L)	2 to 2.75 L/ha	0.8 to 1.1 L/ac	
plus cyanazine	1.8 to 2.25 kg/ha		
BLADEX 90 DF (90 DF)	2 to 2.5 kg/ha	0.8 to 1 kg/ac	
nicosulfuron	25 g/ha		Use only when the corn is between the 4 and 8 leaf stage. See precautions for ACCENT and PARDNER.
ACCENT (75DF)	33 g/ha	13 g/ac	
plus bromoxynil	0.28 kg/ha		
PARDNER (280g/L)	1 L/ha	0.4 L/ac	
plus non-ionic surfactant	0.2% v/v	0.2% v/v	
nicosulfuron	25 g/ha		Do not apply to corn beyond the 6 leaf stage, see precautions for ACCENT and BANVEL II.
ACCENT (75DF)	33 g/ha	13 g/ac	
plus dicamba	0.288 kg/ha		
BANVEL II (480g/L)	0.6 L/ha	0.24 L/ac	
plus non-ionic surfactant	0.2% v/v	0.2% v/v	
nicosulfuron	25 g/ha		Do not apply to corn beyond the 6 leaf stage, see precautions for ACCENT and MARKSMAN.
ACCENT (75DF)	33 g/ha	13 g/ac	
plus dicamba/ atrazine	1 kg/ha		
MARKSMAN ((1:2)401g/L)	2.5 L/ha	1 L/ac	
plus non-ionic surfactant	0.2% v/v	0.2% v/v	
nicosulfuron/rimsulfuron	25 g/ha		One solupak of ULTIM treats 1 ha (2.5 ac). This treatment provides improved control of larger velvetleaf (to 6 leaf stage) and common ragweed (to 8 leaf stage), and can be applied from the 3 to 6 leaf stage of corn. If grass and broadleaf weed growth stages do not coincide, then a sequential application of nicosulfuron/rimsulfuron and bromoxynil plus atrazine is required. DO NOT apply nicosulfuron/rimsulfuron to corn treated with organophosphorous insecticides. DO NOT USE ON SWEET OR SEED CORN.
ULTIM ((1:1)25 DF)	100 g/ha	40 g/ac	
plus bromoxynil	0.14 kg/ha		
PARDNER (280g/L)	0.5 L/ha	0.2 L/ac	
plus atrazine	0.5 kg/ha		
ATRAZINE 480 (480g/L)	1.04 L/ha	0.42 L/ac	
ATRAZINE (90WG)	0.56 kg/ha	0.22 kg/ac	
plus non-ionic surfactant	0.2 % v/v	0.2 % v/v	
nicosulfuron/rimsulfuron	25 g/ha		One solupak of ULTIM treats 1 ha (2.5 ac). Refer to product label(s) for weeds controlled, timing of application, and use precautions. If grass and broadleaf weed growth stages do not coincide, then a sequential application of nicosulfuron/rimsulfuron and bromoxynil is required. DO NOT apply nicosulfuron/rimsulfuron to corn treated with organophosphorous insecticides. DO NOT USE ON SWEET OR SEED CORN.
ULTIM ((1:1)25 DF)	100 g/ha	40 g/ac	
plus bromoxynil	0.28 kg/ha		
PARDNER (280g/L)	1 L/ha	0.4 L/ac	
plus non-ionic surfactant	0.2 % v/v	0.2 % v/v	

nicosulfuron/rimsulfuron ULTIM ((1:1)37.4 DF) plus cyanazine BLADEX 90 DF (90 DF) plus non-ionic surfactant	25 g/ha 67 g/ha 0.75 kg/ha 0.83 kg/ha 0.2 % v/v	 27 g/ac 0.33 kg/ac 0.2 % v/v	Use only the dry formulation of cyanazine. Add a non-ionic surfactant at 2 L per 1000 L of spray solution (0.2 % v/v). Refer to product label(s) for weeds controlled, timing of application, and use precautions. If grass and broadleaf weed growth stages do not coincide, then a sequential application of nicosulfuron/rimsulfuron and cyanazine is required. DO NOT apply nicosulfuron/rimsulfuron to corn treated with organophosphorous insecticides. DO NOT USE ON SWEET OR SEED CORN.
nicosulfuron/rimsulfuron ULTIM ((1:1)37.4 DF) plus dicamba BANVEL II (480g/L) plus non-ionic surfactant	25 g/ha 67 g/ha 0.288 kg/ha 0.6 L/ha 0.2 % v/v	 27 g/ac 0.24 L/ac 0.2 % v/v	Add a non-ionic surfactant at 2 L per 1000 L of spray solution (0.2 % v/v). Refer to product label(s) for weeds controlled, timing of application, and use precautions. If grass and broadleaf weed growth stages do not coincide, then a sequential application of nicosulfuron/rimsulfuron and dicamba is required. DO NOT apply nicosulfuron/rimsulfuron to corn treated with organophosphorous insecticides. DO NOT USE ON SWEET OR SEED CORN.
nicosulfuron/rimsulfuron ULTIM ((1:1)37.4 DF) plus dicamba/atrazine MARKSMAN ((1:2)401g/L) plus a non-ionic surfactant	25 g/ha 67 g/ha 1.003 kg/ha 2.5 L/ha 0.2 % v/v	 27 g/ac 1 L/ac 0.2 % v/v	This tank mix may be applied up to the 5 leaf stage of corn. Apply one water soluble bag/ha of nicosulfuron/rimsulfuron (ULTIM). If grass and broadleaf weed growth stages do not coincide, then a sequential application of nicosulfuron/rimsulfuron and dicamba/atrazine is required. DO NOT apply to corn treated with organophosphorous insecticides. DO NOT APPLY TO SWEET OR SEED CORN.
nicosulfuron/rimsulfuron ULTIM ((1:1)37.4 DF) plus flumetsulam/clopyralid/ 2,4-D STRIKER ((1:2.7:5.4)84.3WG) plus non-ionic surfactant	25 g/ha 67 g/ha 236 g/ha 280 g/ha 0.25 % v/v	 27 g/ac 112 g/ac 0.25 % v/v	ULTIM and STRIKER are packaged in unit area solupaks. Each solupak of ULTIM treats 1 ha (2.5 acres). Each solupak of STRIKER treats 0.8 ha (2 acres). Apply up to the 6 leaf stage of corn. DO NOT apply to corn treated with an organophosphate insecticide. DO NOT USE ON SWEET CORN OR SEED CORN.
nicosulfuron/rimsulfuron + flumetsulam/clopyralid/2,4-D ULTIMAX (ULTIM ((1:1)37.4) + MAX ((1:2.7:5.4)84.3WG)) plus non-ionic surfactant	25 g/ha + 236 g/ha 67 + 280 g/ha 0.25 % v/v	 27 + 112 g/ac 0.25 % v/v	ULTIMAX is a package of ULTIM (37.4 DF) and MAX (84.3 WG). Each water soluble bag of ULTIMAX treats 1 ha (2.5 acres). Apply up to the 6 leaf stage of corn. DO NOT apply to corn treated with an organophosphate insecticide. DO NOT USE ON SWEET CORN OR SEED CORN.
pendimethalin PROWL 400 (400g/L) plus atrazine ATRAZINE 90W (90WP) AATREX NINE-O (90WG)	1.68 kg/ha 4.2 L/ha 1.53 kg/ha 1.7 kg/ha 1.7 kg/ha	 1.68 L/ac 0.68 kg/ac 0.68 kg/ac	Refer to "Notes on Chemicals" for each individual product for details. Annual grasses can not be beyond the 2 leaf stage and corn not beyond the 4 leaf stage. DO NOT USE ON SWEET OR SEED CORN.
pendimethalin PROWL 400 (400g/L) plus cyanazine BLADEX 90 DF (90 DF)	1.68 kg/ha 4.2 L/ha 2.25 kg/ha 2.5 kg/ha	 1.68 L/ac 1 kg/ac	Refer to recommendations for each individual product for details. Annual grasses can not be beyond the 2 leaf stage and corn not beyond the 3 leaf stage. Avoid application under adverse growing conditions. DO NOT USE ON SWEET OR SEED CORN.
pendimethalin PROWL 400 (400g/L) plus dicamba BANVEL II (480g/L)	1.68 kg/ha 4.2 L/ha 0.288 to 0.6 kg/ha 0.6 to 1.25 L/ha	 1.68 L/ac 0.24 to 0.5 L/ac	Refer to recommendations for each individual product for details. Annual grasses can not be beyond the 2 leaf stage and corn not beyond the 4 leaf stage. DO NOT apply if temperature exceeds 25°C at application time. Avoid application under adverse growing conditions. DO NOT USE ON SWEET OR SEED CORN. See precautions for BANVEL II alone POST.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
pendimethalin	1.68 kg/ha		Refer to recommendations for each individual product for details. DO NOT USE ON SWEET OR SEED CORN. See precautions for BANVEL II alone POST.
PROWL 400 (400g/L)	4.2 L/ha	1.68 L/ac	
plus dicamba/atrazine	1.48 to 1.8 kg/ha		
MARKSMAN ((1:2)401g/L)	3.7 to 4.5 L/ha	1.5 to 1.8 L/ac	
rimsulfuron	15 g/ha		Refer to product label(s) for weeds controlled, timing of application, and use precautions. If grass and broadleaf weed growth stages do not coincide, then a sequential application of rimsulfuron and dicamba is required. DO NOT APPLY TO SWEET OR SEED CORN.
ELIM EP (25 DF)	60 g/ha	24 g/ac	
plus dicamba	0.288 kg/ha		
BANVEL II (480g/L)	0.6 L/ha	0.24 L/ac	
plus non-ionic surfactant	0.2 % v/v	0.2 % v/v	
rimsulfuron	15 g/ha		If grass and broadleaf weed growth stages do not coincide, then a sequential application of rimsulfuron and dicamba/atrazine is required. DO NOT APPLY TO SWEET OR SEED CORN.
ELIM EP (25 DF)	60 g/ha	24 g/ac	
plus dicamba/atrazine	1.003 kg/ha		
MARKSMAN ((1:2)401g/L)	2.5 L/ha	1 L/ac	
plus a non-ionic surfactant	0.2 % v/v	0.2 % v/v	
rimsulfuron	12.5 g/ha		Refer to individual product labels for weeds controlled, timing of application and use precautions. Apply early postemergence to corn from the spike to 3 leaf stage (2 visible collars or 20 cm in height - leaf extended). In addition to other weeds this tankmix will control yellow foxtail, crabgrass and Eastern black nightshade. DO NOT APPLY TO SWEET OR SEED CORN.
ELIM EP (25 DF)	50 g/ha	20 g/ac	
plus pendimethalin	1 kg/ha		
PROWL 400 (400g/L)	2.5 L/ha	1 L/ac	
plus dicamba	0.3 kg/ha		
BANVEL II (480g/L)	0.625 L/ha	0.25 L/ac	
plus non-ionic surfactant	0.2 % v/v	0.2 % v/v	
rimsulfuron	12.5 g/ha		Refer to individual product labels for weeds controlled and use precautions. Apply early postemergence to corn from the spike to 3 leaf stage (2 visible collars or 20 cm in height - leaf extended). This tankmix will control yellow foxtail and crabgrass. DO NOT APPLY TO SWEET OR SEED CORN.
ELIM EP (25 DF)	50 g/ha	20 g/ac	
plus pendimethalin	1 kg/ha		
PROWL 400 (400g/L)	2.5 L/ha	1 L/ac	
plus non-ionic surfactant	0.2 % v/v	0.2 % v/v	
s-metolachlor/benoxacor	1.14 to 1.6 kg/ha		Application can be made when the corn is in the spike to 2 leaf stage and annual grasses are not beyond the 2 leaf stage. See special notes on postemergence use of dicamba and related hormone chemicals and precautions for BANVEL II alone POST.. DO NOT USE ON SWEET OR SEED CORN.
DUAL II MAGNUM (915g/L)	1.25 to 1.75 L/ha	0.5 to 0.7 L/ac	
plus atrazine	1.01 to 1.49 kg/ha		
AATREX NINE-O (90WG)	1.12 to 1.65 kg/ha	0.45 to 0.66 kg/ac	
ATRAZINE 480 (480g/L)	2.1 to 3.1 L/ha	0.84 to 1.24 L/ac	
plus dicamba	0.288 to 0.6 kg/ha		
BANVEL II (480g/L)	0.6 to 1.25 L/ha	0.24 to 0.5 L/ac	

s-metolachlor/benoxacor DUAL II MAGNUM (915g/L) plus atrazine ATRAZINE 480 (480g/L) AATREX NINE-O (90WG) or s-metolachlor/benoxacor/ atrazine PRIMEXTRA II MAGNUM ((1:0.8)720g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 1.01 to 1.49 kg/ha 2.1 to 3.1 L/ha 1.12 to 1.65 kg/ha 2.16 to 2.88 kg/ha 3 to 4L/ha	0.5 to 0.7 L/ac 0.84 to 1.24 L/ac 0.45 to 0.66 kg/ac 1.2 to 1.6 L/ac	High rates should be used for heavy grass infestation areas and for fall panicum control. Corn should be at the spike to 2 leaf stage. DO NOT add oil or surfactants to this mixture.
s-metolachlor/benoxacor DUAL II MAGNUM (915g/L) plus dicamba BANVEL II (480g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 0.288 to 0.6 kg/ha 0.6 to 1.25 L/ha	0.5 to 0.7 L/ac 0.24 to 0.5 L/ac	Application can be made when the corn is in the spike to 2 leaf stage and annual grasses are not beyond the 2 leaf stage. See special notes on postemergence use of dicamba and related hormone chemicals and precautions for BANVEL II alone POST. DO NOT USE ON SWEET OR SEED CORN.
s-metolachlor/benoxacor DUAL II MAGNUM (915g/L) plus dicamba/ atrazine MARKSMAN ((1:2)401g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 1.48 to 1.8 kg/ha 3.7 to 4.5 L/ha	0.5 to 0.7 L/ac 1.5 to 1.8 L/ac	Application can be made when the corn is in the spike to 2 leaf stage and annual grasses are not beyond the 2 leaf stage. See special notes on postemergence use of dicamba and related hormone chemicals . S precautions for BANVEL II alone POST. DO NOT USE ON SWEET OR SEED CORN.
s-metolachlor/benoxacor/ atrazine PRIMEXTRA II MAGNUM ((1:0.8)720g/L) plus dicamba BANVEL II (480g/L)	2.16 to 2.88 kg/ha 3 to 4 L/ha 0.288 to 0.6 kg/ha 0.6 to 1.25 L/ha	 1.2 to 1.6 L/ac 0.24 to 0.5 L/ac	Application can be made when the corn is in the spike to 2 leaf stage and annual grasses are not beyond the 2 leaf stage. See special notes on postemergence use of dicamba and related hormone chemicals and precautions for BANVEL II alone POST. DO NOT USE ON SWEET OR SEED CORN.
sethoxydim POAST ULTRA (450g/L) plus bentazon/ atrazine LADDOK ((1:1)400g/L) plus oil concentrate ASSIST	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 1 to 1.6 kg/ha 2.5 to 4 L/ha 2 L/ha	 0.13 to 0.19 L/ac 1 to 1.6 L/ac 0.8 L/ac	FOR USE ON SETHOXYDIM RESISTANT (POAST PROTECTED) CORN ONLY. Apply to emerged grasses in the 1 to 5 leaf stage during active growth while crop is small enough to permit thorough spray coverage and broadleaf weeds are within the stages listed on the bentazon/atrazine label. Use bentazon/atrazine at 1.2 to 1.6 kg/ha (LADDOK at 3 to 4 L/ha (1.2 to 1.6 L/ac)) for nutsedge control; repeat 7 to 10 days later if necessary.
2,4-D/ dicamba/ mecoprop KIL-MOR (485g/L)	0.413 to 0.534 kg/ha 0.85 to 1.1 L/ha	 0.34 to 0.44 L/ac	Apply an overall spray until corn is 15 cm high (leaf extended): thereafter use drop nozzles. Jerusalem artichoke (30-40 cm in height) can be controlled with 2 sprays (10-14 days apart) per season for 2 seasons (see specific label instructions). DO NOT add oil or surfactant. See special notes on postemergence use of dicamba and related hormone chemicals. DO NOT USE ON SEED OR SWEET CORN.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
glufosinate ammonium LIBERTY 200 SN (200g/L)	0.3 to 0.5 kg/ha 1.5 to 2.5 L/ha	 0.6 to 1 L/ac	FOR USE ONLY ON FIELD AND SEED CORN SPECIALLY DEVELOPED TO BE TOLERANT TO LIBERTY. Application after the 8 leaf stage of corn must be made as a directed spray below the whorl of the corn plant. LIBERTY is a contact herbicide and has no residual soil activity. Consult the product label for rate recommendations for specific weeds and weed stages. Ammonium sulphate can be added at 6 L/ha (2.4 L/ac)(liquid) or 3.3 kg/ha (1.3 kg/ac)(dry) for improved control of specific weeds. DO NOT add oil or any other surfactants.
linuron AFOLAN F (480g/L) LOROX DF (50 DF) LINURON 480 (480g/L)	1.1 to 2.25 kg/ha 2.3 to 4.7 L/ha 2.2 to 4.5 kg/ha 2.4 to 4.5 L/ha	 0.92 to 1.88 L/ac 0.88 to 1.8 kg/ac 0.96 to 1.8 L/ac	Apply in oil water emulsion as directed spray at low pressure with drop nozzles after corn is 30 cm or more in height. The spray must be placed under the corn leaves but on the weeds. Use this treatment as a rescue from weeds escaping a previous treatment and for nutsedge or horsetail top growth burn down. DO NOT apply linuron after corn is beginning to tassel. Follow label directions carefully.
MCPA MCPA AMINE (500g/L)	0.38 to 0.63 kg/ha 0.76 to 1.26 L/ha	 0.3 to 0.5 L/ac	Controls triazine resistant and most other broadleaf weeds. Treat before the corn reaches 15 cm tall (leaf extended). Use the lower rate for small, actively growing weeds and the higher rate for larger weeds or under adverse weather conditions. Top growth of fully developed HORSETAIL (15-25 cm) can be controlled with 1 L/ha (0.4 L/ac) of product; a directed late post application using drop nozzles to avoid corn injury is necessary. DO NOT USE ON SEED OR SWEET CORN.
nicosulfuron/rimsulfuron ULTIM ((1:1) 25 DF) plus bromoxynil PARDNER (280g/L) plus non-ionic surfactant	25 g/ha 100 g/ha 0.28 kg/ha 1 L/ha 0.2 % v/v	 40 g/ac 0.4 L/ac 0.2 % v/v	One solupak of ULTIM treats 1 ha (2.5 ac). Delay application until 8 leaf stage of corn, when a height differential can be established between the corn and target weeds. Application should be made before the initiation of corn silking. Direct spray solution below crop canopy. Apply one water soluble bag/ha of nicosulfuron/rimsulfuron (ULTIM). DO NOT USE ON SWEET OR SEED CORN. Provides later season quackgrass control.
nicosulfuron/rimsulfuron ULTIM ((1:1) 37.4 DF) plus non-ionic surfactant	25 g/ha 67 g/ha 0.2 % v/v	 27 g/ac 0.2 % v/v	Delay application until 8 leaf stage of corn, when a height differential can be established between the corn and target weeds. Application should be made before the initiation of silking. Direct spray solution below crop canopy. Apply one water soluble bag/ha of nicosulfuron/rimsulfuron (ULTIM). DO NOT USE ON SWEET OR SEED CORN. Provides later season quackgrass control.
[illegible]			
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360 g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	1.71 to 2.52 kg/ha 4.75 to 7 L/ha 4.75 to 7 L/ha 1.567 to 2.31 kg/ha 4.75 to 7 L/ha	 1.9 to 2.8 L/ac 1.9 to 2.8 L/ac 1.9 to 2.8 L/ac	DO NOT apply after corn has started to silk. Corn will be killed in the areas sprayed and may be damaged by spray drift in adjacent areas. Knapsack application of 100 mL ROUNDUP TRANSORB in 5 L of water applied to thoroughly wet the foliage, but not to runoff, is suggested for small areas to reduce drift and area of corn killed. Apply after Canada thistle has started flowering. Quackgrass should be actively growing.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360 g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	2.52 to 4.32 kg/ha 7 to 12 L/ha 7 to 12 L/ha 2.31 to 3.96 kg/ha 7 to 12 L/ha	 2.8 to 4.8 L/ac 2.8 to 4.8 L/ac 2.8 to 4.8 L/ac	DO NOT apply after corn has started to silk. Corn will be killed in the areas sprayed and may be damaged by spray drift in adjacent areas. Knapsack application of 100 mL ROUNDUP TRANSORB in 5 L of water applied to thoroughly wet the foliage, but not to runoff, is suggested for small areas to reduce drift and area of corn killed. Apply after field bindweed has reached full flowering, or milkweed has reached the bud stage. Quackgrass should be actively growing.

Corn Leaf Stages

Counting the leaves on a corn plant sounds like an easy task but there are a few complications that can cause you to miscount. It is important when reading labels or other information to know which leaf counting method they are referring to.

There are several methods of counting leaves. One method counts all leaves including any leaf tip that has emerged from the whorl at the top of the plant (leaf tip method). Another method only counts those leaves that are fully emerged and have the leaf collar showing (leaf collar method). The leaf collar is a light green band that separates the leaf blade and leaf sheath that wraps around the stem. In some states they refer to corn growth stages as V1, V2, V3, etc., where a V3 stage is a plant with 3 collars showing.

In Guide to Weed Control, we are counting leaves that have emerged from the whorl and the leaf tip is starting to arch over (leaf over method). This normally occurs when leaves are about 50% emerged. Most product labels also refer to this method of leaf counting but check the label or with the product representative to be sure. Table C gives a comparison among the count methods.

Another complication with leaf counting is that we start with the bottom leaf known as the first leaf. The first leaf is shorter than other leaves and has a round leaf tip. However, as the plant grows the bottom leaves start to die and drop to the ground. A ten leaf corn plant may have one to three leaves that have died. These leaves may not be immediately apparent and care must be taken to count them.

Hint: Start counting from the bottom leaf, and check the first leaf to look for the rounded leaf tip.

It takes about 75 to 80 Crop Heat Units to produce each corn leaf. Therefore at temperatures of 30°C day, and 20°C at night, there is one new leaf every 2 to 3 days; and at 20°C day, and 10°C at night, one new leaf every 4 to 5 days.

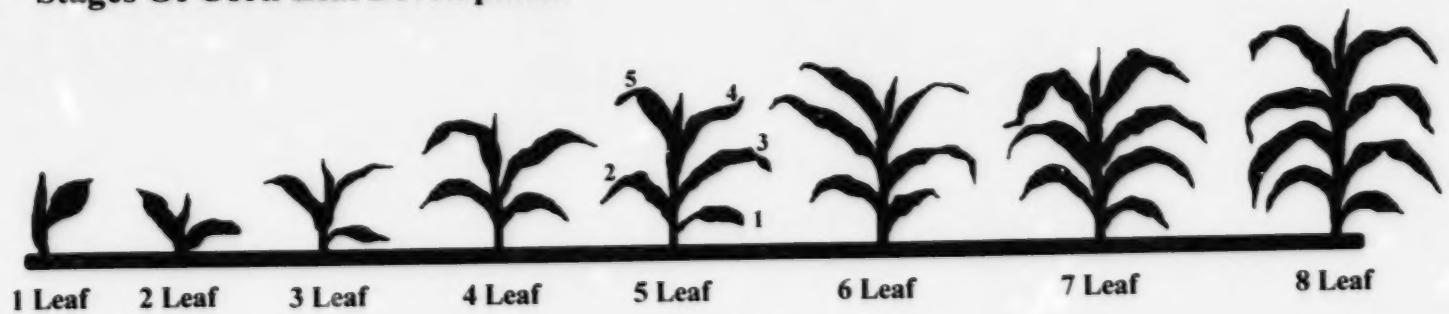
Critical Stage: The Critical Stage to control weeds in corn is the 2 to 8 leaf over stage (3 to 10 leaf tips).

Some product labels also use plant height to indicate crop growth stages. In general, plant height is more variable depending on plant genetics and on the weather of the season. The following table gives some comparative heights for each leaf stage but your plants may be slightly more or less than the stage given depending on genetics and weather. The standing height is measured from the ground surface to the top of the plant as it stands. Leaf extended refers to the height of the plant with the leaves pulled up to their full height.

Table C: Comparative growth stages

Leaf over	Collars	Leaf tips	Standing Height (cm)	Leaf Extended (cm)
2	1	3	5-6	5-11
4	3	5-6	9-17	16-25
6	4-5	7-8	18-33	29-46
8	5-6	9-10	36-54	54-77
10	8	12	58-85	86-112
12	10	14-15	99-114	121-149

Stages Of Corn Leaf Development



Notes:

Weed control ratings are given as 0-9 where 0 indicates no control and 9 indicates 90%-100% control under ideal conditions.

Ratings are subjective values based on best available information and give general comparisons based on use as descibed in this guide.

Crop tolerance ratings are E - Excellent, G - Good, F - Fair, P - Poor.

Under unfavorable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used.

Ratings in **BOLD** suggest the weed is listed on the product label for control or suppression.

Please see product label for more information on registered weed species, product uses and precautions.

Table 11. Corn (Field and Sweet) Herbicide Weed Control Ratings

		Crop			Annual Grasses						Annual Broadleaves											Perennials							
Treatment	**Trade Name**	seed corn	sweet corn	field corn	barnyard grass	crabgrass	fall panicum	foxtail	old witch grass	proso millet	buckwheat, wild	cocklebur	corn spurry	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	triazine resistant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	Crop Tolerance
soil applied grass herbicides																													
dimethenamid	FRONTIER		✓	✓	**9**	**9**	**8/9[a]**	**9**	**9**	4	2	2	2	2	7	2	**8/9[c]**	**7/8**	5	7	3	0	0	0	**8/9[b]**	0	0	0	E
EPTC[+]	ERADICANE		✓	✓	**9**	**9**	**8**	**9**	**9**	7	2	4	**8**	7	**8**	2	8	**7**	7	7	4	2	7	0	**8[a]**	**2[a]**	2	2	E
s-metolachlor/ benoxacor	DUAL II MAGNUM	✓	✓	✓	**9**	**9**	**8/9[a]**	**9**	**9**	4	2	2	2	2	7	2	**8/9[c]**	**7/8**	5	7	3	0	0	0	**8/9[b]**	0	0	0	E
soil applied broadleaf herbicides																													
atrazine	atrazine*	✓	✓	✓	7	4	4	7	7	2	**9**	7	**9**	**9**	**9**	9	9	**9**	**9**	0	5	2	0	0	0	2	2	0	E
dicamba	BANVEL II			✓	0	0	0	0	0	0	**8**	8	**8**	**9**	**9**	**8**	9	**9**	**9**	**9**	**8**	**2**	0	0	0	0	**2**	**2**	G
flumetsulam/clopyralid	FIELDSTAR			✓	0	0	0	0	0	0	9	**9**	?	**9**	**9**	**9**	**9**	**9**	**9**	9	**9**	0	0	0	0	0	7	7	E
simazine	PRINCEP NINE-T, SIMADEX, SIMAZINE 480	✓	✓	✓	**9**	8	7	**9**	**9**	2	**9**	7	9	**9**	**9**	9	9	9	**8**	0	5	2	0	0	5	5	2	2	E
soil applied grass and broadleaf herbicides																													
cyanazine	BLADEX	✓	✓	✓	**7**	**9**	**8**	**9**	**9**	2	**8**	7	?	**8**	**9**	**9**	**9**	7	**8**	0	**5**	0	0	0	0	0	0	0	E
imazethapyr	PURSUIT [1]			✓[1]	**8**	7	7	**9**	9	7	8	6	?	9	**9**	9	**9**	**9**	8	9	**9**	?	?	?	7	5	?	?	E[1]
linuron	AFOLAN F		✓	✓	**7**	**7**	**7**	**7**	**7**	2	**9**	2	**?**	**9**	**9**	**9**	8	**9**	**8**	9	**2**	0	0	0	0	0	0	0	G
pendimethalin	PROWL			✓	**9**	**8**	**9**	**8**	?	5	?	?	?	6	**9**	0	8	**8**	2	**9**	6	?	?	?	?	?	?	?	E
s-metolachlor /benoxacor/atrazine	PRIMEXTRA II MAGNUM	✓	✓	✓	**9**	**9**	**8/9[a]**	**9**	**9**	2	**9**	7	9	**9**	**9**	**9**	**9**	**9**	**9**	7	7	0	0	0	**8/9[b]**	0	0	0	E
postemergent grass herbicides																													
dimethenamid	FRONTIER			✓	**9**	**9**	**8/9[a]**	**9**	**9**	2	0	0	0	0	0	0	**8**	8	0	5	0	0	0	0	0	?	0	0	0	E
nicosulfuron	ACCENT		✓[5]	✓	**9**	5	**9**	**9**	**9**	**9**	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	**9**	0	0	E
nicosulfuron/ rimsulfuron	ULTIM			✓	**9**	5	**9**	**9**	**9**	**9**	?	?	?	5	5	7	2	**9**	?	?	5	?	?	?	?	**9**	?	?	G

Table 11. Corn (Field and Sweet) Herbicide Weed Control Ratings

Treatment	Trade Name	Crop			Annual Grasses						Annual Broadleaves											Perennials							Crop Tolerance
		seed corn	sweet corn	field corn	barnyard grass	crabgrass	fall panicum	foxtail	old witch grass	proso millet	buckwheat, wild	cocklebur	corn spurry	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	triazine resistant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	
rimsulfuron	ELIM EP			✓	9	5	9	8	9	7	?	?	?	5	5	7	2	9	?	?	5	?	?	?	?	?	?	?	G
s-metolachlor/ benoxacor	DUAL II MAGNUM	✓	✓	✓	9	9	8/9[a]	9	9	2	0	0	0	0	7	0	8	8	0	5	0	0	0	0	0	0	0	0	E
sethoxydim	POAST ULTRA[2]			✓[2]	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	E[2]
postemergent broadleaf herbicides																													
2,4-D	2,4-D*			✓	0	0	0	0	0	0	7	8	2	7	9	9	7	9	9	8	9	7	0	0	0	0	8	8	G
2,4-D/mecoprop/ dicamba	KIL-MOR			✓	0	0	0	0	0	0	9	8	9	9	9	9	8	9	9	9	8	9	0	0	0	0	8	8	G
2,4-DB*	2,4-DB*			✓	0	0	0	0	0	0	8	8	0	0	7	8	7	9	9	9	9	8	0	0	0	0	8	8	G
MCPB/MCPA	TROPOTOX PLUS, CLOVITOX PLUS			✓	0	0	0	0	0	0	8	8	0	0	7	8	7	9	9	9	9	8	0	0	0	0	8	8	G
atrazine/2,4-D	SHOTGUN			✓	0	0	0	0	0	0	9	7	?	9	9	9	?	9	9	9	9	0	?	0	0	0	?	?	E
atrazine + oil	atrazine* + oil	✓	✓	✓	7	2	0	7	7	2	9	7	9	9	9	9	9	9	9	0	7	7	5	2	5	5	7	2	G
atrazine + pyridate	atrazine* + LENTAGRAN	✓	✓	✓	7	0	?	7	?	?	7	?	?	7	9	8	9	9	9	9	8	?	?	?	?	?	?	?	E
bentazon	BASAGRAN FORTE	✓	✓	✓	0	0	0	0	0	0	7	9	9	9	8	9	7	8	8	9	9	7	0	0	8	0	7	8	E
bentazon/atrazine	LADDOK	✓	✓	✓	0	0	0	0	0	0	9	9	9	9	9	9	9	9	9	9	9	7	0	0	8	0	7	7	E
bromoxynil	PARDNER	✓	✓	✓	0	0	0	0	0	0	9	8	?	9	9	8	9	8	9	9	9	7	0	0	0	0	7	7	E
bromoxynil/MCPA	BUCTRIL M			✓	0	0	0	0	0	0	9	9	?	9	9	9	9	8	9	9	9	7	7	0	0	0	7	7	G
dicamba	BANVEL II			✓	0	0	0	0	0	0	9	9	9	9	9	7	9	9	9	9	9	8	0	0	0	0	9	8	G
dicamba/atrazine	MARKSMAN			✓	7	0	0	7	7	0	9	9	9	9	9	9	9	9	9	9	9	8	0	0	0	0	8	8	E
difluenzopyr/dicamba	DISTINCT			✓	?	?	?	?	?	?	9	?	?	9	9	?	?	9	9	9	9	?	?	?	?	?	?	?	E
flumetsulam/clopyralid	FIELDSTAR			✓	0	0	0	0	0	0	8	8	?	9	9	9	9	9	9	9	9	0	0	0	0	0	7	7	E
flumetsulam/ clopyralid /2,4-D	STRIKER			✓	0	0	0	0	0	0	8	8	?	7	9	9	7	9	9	9	9	5	7	0	0	0	7	7	E
MCPA (amine)	MCPA *			✓	0	0	0	0	0	0	?	7	7	0	9	9	?	7	9	9	7	7	8	0	0	0	7	7	G
prosulfuron + dicamba	PEAKPLUS[6]			✓	0	0	0	0	0	0	?	9	?	9	9	9	?	9	9	9	9	?	?	?	?	?	?	?	E
postemergent grass and broadleaf herbicides																													
cyanazine	BLADEX	✓	✓	✓	7	9	8	9	9	5	8	8	?	8	9	9	9	7	9	0	8	2	2	0	0	0	2	2	E
glufosinate ammonium	LIBERTY 200 SN[3]	✓[3]		✓[3]	9	9	9	9	9	9	8	9	?	8/9	9	9	9	9	9	9	8/9	6	6	?	6	6/7	8	7	E[3]
glyphosate	ROUNDUP TRANSORB[4]			✓[4]	9	9	9	9	9	9	8	9	8	8	9	9	9	9	9	9	9	7/8	?	8	8	9	8	9	E[4]
imazethapyr	PURSUIT[1]			✓[1]	9	8	8	9	9	8	?	?	?	?	8	?	9	9	?	9	8	?	0	0	?	0	?	0	E[1]
imazethapyr/atrazine	PATRIOT[1]			✓[1]	9	8	9	9	9	8	9	8	8	9	9	9	9	9	8	9	9	0	0	0	7	5	7	0	E[1]

Table 11. Corn (Field and Sweet) Herbicide Weed Control Ratings

Treatment	Trade Name	Crop			Annual Grasses						Annual Broadleaves											Perennials							Crop Tolerance
		seed corn	sweet corn	field corn	barnyard grass	crabgrass	fall panicum	foxtail	old witch grass	proso millet	buckwheat, wild	cocklebur	corn spurry	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	triazine resistant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	
nicosulfuron/ rimsulfuron + flumetsulam/ clopyralid /2,4-D	ULTIMAX [6]			✓	9	5	9	9	9	9	5	9	?	7	9	8	7	9	9	9	9	?	?	?	?	9	?	?	G
s-metolachlor /benoxacor /atrazine	PRIMEXTRA II MAGNUM	✓	✓	✓	9	9	8/9[a]	9	9	2	9	7	9	9	9	9	9	9	9	7	7	0	0	0	3	0	0	0	E
directed postemergence																													
glufosinate ammonium	LIBERTY 200 SN [3]	✓[3]		✓[3]	9	9	9	9	9	9	8	9	?	8/9	9	9	9	9	9	9	8/9	?	?	?	0	6/7	8	7	E[3]
linuron	AFOLAN F, LINURON 480, LOROX		✓	✓	9	7	9	8	9	8	9	9	9	9	9	9	9	9	9	9	9	7	8	7	8	7	8	7	G
nicosulfuron/ rimsulfuron	ULTIM			✓	9	5	9	9	9	9	?	?	?	5	5	7	2	9	?	?	5	?	?	?	?	9	?	?	G

* Various formulations available, see Table 1

[1] For use on CLEARFIELD corn (imazethapyr tolerant) only

[2] For use on sethoxydim (POAST PROTECTED) tolerant corn only.

[3] For use on glufosinate ammonium (LIBERTY 200 SN) tolerant corn only.

[4] For use on ROUNDUP READY corn (glyphosate tolerant) only.

[5] Use only on selected varieties - see precautions for tolerant varieties on label

[6] indicates herbicides sold as a co-pack under this trade name

? Insufficient information available to make a rating

[a] Use the high rate of herbicide for optimum control

[b] Use PPI timing for optimum control

[c] Use PRE timing for optimum control

Table 11.1 Postemergence Corn Herbicides Leaf Stages

		Annual Grasses						Annual Broadleaf										Perennials
Trade Name	**Stage of Corn (leaf stage)**	**barnyard grass**	**crabgrass**	**fall panicum**	**green foxtail**	**old witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**jimsonweed**	**lady's-thumb**	**lamb's-quarters**	**wild mustard**	**nightshade**	**pigweed**	**ragweed**	**velvetleaf**	**quackgrass**
ACCENT	1 to 8	6		6	6	6	6											3 to 6
ELIM	spike to 3	1 to 4													2 to 4			
LIBERTY	up to 8	5	5	4	5	4	5		4		6	6	4		6	7	4	1 to 4
ULTIM	1 to 6	6		6	6	6	6											3 to 6
ULTIMAX	1 to 6	6		6	6	6	6		2 to 4		2 to 4	2 to 4	2 to 4		2 to 6	2 to 4	2 to 4	3 to 6
atrazine	tolerant at all stages									10 cm	10 cm	10 cm	10 cm	10 cm	10 cm	7 to 10 cm	5 to 10 cm	
BANVEL II	up to 5							4	4	4	4	4	4	4	4	4	4	
BANVEL II + atrazine	up to 5							4	6	6	6 to 8	6	6	6	6	6	6	
DISTINCT	2 to 6							6	6	6	6 to 8	6	6	6	6	6	6	
PARDNER	4 to 8							8	4		4	8	4		4	4	4	
PARDNER + atrazine	4 to 8							8	4		4	8	4		6	8	6	
ROUNDUP TRANSORB	up to 8	25 cm	25 cm	25 cm	25 cm	25 cm	25 cm	25 cm	25 cm	25 cm	15 cm	25 cm	25 cm	25 cm	25 cm	25 cm	25 cm	25 cm
PEAKPLUS	up to 6								6		4	6	12		6	8	6	
STRIKER	up to 6								2 to 4	2 to 4		2 to 4	2 to 4		2 to 4	2 to 4	2 to 4	

Expressed as leaf stages except as indicated

Flax-linseed

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
triallate AVADEX BW (400g/L)	1.7 to 2.2 kg/ha 4.25 to 5.5 L/ha	 1.7 to 2.2 L/ac	For the control of wild oats. Triallate can be applied before or after seeding and must be worked into the soil by two passes of cultivator.
clethodim SELECT (240g/L) plus surfactant AMIGO	0.03 to 0.09 kg/ha 0.13 to 0.38 L/ha 0.5 to 1 % v/v	 0.05 to 0.15 L/ac 0.5 to 1 % v/v	Flax is tolerant at any growth stage. Apply when the annual grasses and volunteer cereals are in the 2 to 6 leaf stage. Apply to quackgrass in the 2 to 5 leaf stage. Use the higher rate for control of quackgrass.
diclofop-methyl HOE-GRASS 284 (284g/L)	0.71 to 0.795 kg/ha 2.5 to 2.8 L/ha	 1 to 1.12 L/ac	Apply in the spring when annual grasses are in the 1 to 5 leaf stage. The higher rate (2.8 L/ha (1.12 L/ac)) must be used for control of wild oats in the 4 to 5 leaf stage.
fluazifop-p-butyl FUSILADE II (125g/L)	0.075 kg/ha 0.6 L/ha	 0.24 L/ac	Apply at 2-4 leaf stage of annual grasses.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply at 3-5 leaf stage of quackgrass.
quizalofop-p-ethyl ASSURE II (96g/L) plus oil concentrate CANPLUS 411 or SURE-MIX	0.036 to 0.072 kg/ha 0.375 to 0.75 L/ha 5 to 10 L/1000L 0.5 % v/v	 0.15 to 0.3 L/ac 5 to 10 L/1000L 0.5 % v/v	Apply to emerged annual grasses and volunteer cereals in the 2 leaf to tillering stage and to quackgrass in the 2 to 6 leaf stage of growth. Use the 0.375 L/ha (0.15 L/ac) rate for control of volunteer corn, volunteer cereals and green foxtail. The 0.5 L/ha (0.2 L/ac) rate provides suppression of quackgrass and will also control barnyard grass. Use the 0.75 L/ha (0.3 L/ac) rate for control of quackgrass. Use the higher rate of CANPLUS 411 when wild oats and quackgrass are the target weeds or under drought conditions. DO NOT apply to flax within 82 days of harvest.
sethoxydim POAST ULTRA (450g/L) plus oil concentrate ASSIST or surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha 1 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac 0.4 L/ac	For annual grasses and volunteer cereals. Use the higher rate when volunteer cereals are present. Treat the 1 to 6 leaf stage of annual grass. Flax is tolerant at any stage of growth. Apply using 110 to 200 L/ha of water (44-80 L/ac).
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 1 to 2 L/ha	 0.45 L/ac 0.4 to 0.8 L/ac	For quackgrass control. Thorough preplant tillage will ensure more uniform quackgrass emergence. Apply using 100 to 200 L/ha of water (40-80 L/ac).

bentazon BASAGRAN (480g/L) plus oil concentrate ASSIST	0.84 to 1.08 kg/ha 1.75 to 2.25 L/ha 2 L/ha	 0.7 to 0.9 L/ac 0.8 L/ac	Apply when flax is 5 cm or higher and weeds are small and actively growing. Top growth of nutsedge and Canada thistle are controlled and field bindweed may be suppressed by 2 applications of 1.75 L/ha (0.7 L/ac) (0.84 kg active/ha); 10 days apart may be required. A new flush of weeds may emerge after the first flush has been controlled. Cool weather or drought may reduce control. Reduce rate of oil concentrate to 1 L/ha (0.4 L/ac) under abnormally hot and humid weather conditions or temporary crop injury may occur.
bromoxynil/ MCPA BUCTRIL M ((1:1)560g/L)	0.56 kg/ha 1 L/ha	 0.4 L/ac	Apply when the flax is 5 to 10 cm high before weeds have developed beyond the 4 leaf stage. DO NOT use if the daytime temperature is over 29°C.
MCPA ESTEMINE MCPA (500g/L)	0.42 to 0.55 kg/ha 0.84 to 1.1 L/ha	 0.34 to 0.44 L/ac	Flax may be treated when 5 cm tall to bud stage. Best weed control is obtained if the application is made when the weeds are small (approx. 5 cm tall).
clethodim SELECT (240g/L) plus bromoxynil/ MCPA BUCTRIL M ((1:1)560g/L) plus surfactant AMIGO	0.045 kg/ha 0.19 L/ha 0.56 kg/ha 1 L/ha 0.5 % v/v	 0.076 L/ac 0.4 L/ac 0.5 % v/v	Apply when flax is 5 to 10 cm high and weeds are in the seedling stage for best results. Do not use if daytime temperature is over 25 C.
sethoxydim POAST ULTRA (450g/L) plus bromoxynil/ MCPA BUCTRIL M ((1:1)560g/L) plus oil concentrate ASSIST or surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 0.56 kg/ha 1 L/ha 2 L/ha 1 L/ha	 0.13 to 0.19 L/ac 0.4 L/ac 0.8 L/ac 0.4 L/ac	Apply when flax is 5 to 10 cm high before weeds have developed beyond the 4 leaf stage. DO NOT use if the daytime temperature is over 29°C. Apply using 100 to 200 L/ha of water (40-80 L/ac).
sethoxydim POAST ULTRA (450g/L) plus MCPA MCPA AMINE (500g/L) plus oil concentrate ASSIST or surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 0.42 to 0.55 kg/ha 0.84 to 1.1 L/ha 2 L/ha 1 L/ha	 0.13 to 0.19 L/ac 0.34 to 0.44 L/ac 0.8 L/ac 0.4 L/ac	Flax may be treated when 5 cm tall to bud stage. Best weed control is obtained if the application is made when the weeds are small (approximately 5 cm tall). Apply using 100 to 200 L/ha of water (40-80 L/ac).
diquat REGLONE (200g/L) plus AGRAL 90	0.3 to 0.55 kg/ha 1.5 to 2.75 L/ha 0.1 % v/v	 0.6 to 1.1 L/ac 0.1 % v/v	Apply by aircraft in at least 20 L of water/ha (8 L/ac) when the crop is at 75% boll turn stage. DO NOT apply to immature crop. This application reduces dry down time and eliminates the need for swathing.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
glyphosate	0.89 kg/ha		Apply in 50-100 L/ha (20-40 L/ac) water when the crop is at 30% grain moisture or less (consult label for visual indicators). Apply at least 7 days prior to harvest. DO NOT apply to seed crops. DO NOT apply with aircraft.
ROUNDUP TRANSORB (360g/L)	2.5 L/ha	1 L/ac	
GLYFOS (360g/L)	2.5 L/ha	1 L/ac	

Forage Legumes (Direct Seeded)

Apply all treatments in 100 to 200 L/ha (40-80 L/ac) water except where otherwise noted.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

EPTC EPTAM (800g/L)	3.4 kg/ha 4.25 L/ha	1.7 L/ac	•For pure stands of alfalfa or bird's-foot trefoil. •Apply to a dry soil surface and incorporate into the soil immediately. •Some broadleaf weeds such as ragweed, mustards, and pigweeds frequently escape.
trifluralin TREFLAN (480g/L) RIVAL DF (60 DF) BONANZA 400 (400g/L)	0.6 to 1.148 kg/ha 1.25 to 2.4 L/ha 1 to 1.91 kg/ha 1.5 to 2.75 L/ha	 0.5 to 0.96 L/ac 0.4 to 0.76 kg/ac 0.6 to 1.1 L/ac	•For pure stands of alfalfa. •See "Notes on Chemicals" section for incorporation instructions. •Some activity on broadleaf weeds. •Use lower rate on sandy soils, higher rate for loam to clay soils.
clethodim SELECT (240g/L) plus surfactant AMIGO	0.03 to 0.09 kg/ha 0.13 to 0.38 L/ha 0.5 to 1 % v/v	 0.05 to 0.15 L/ac 0.5 to 1 % v/v	•For pure stands of alfalfa only. •Alfalfa is tolerant at any growth stage. •Apply when the annual grasses and volunteer cereals are in the 2 to 6 leaf stage. •Use the higher rate for control of quackgrass. •ALLOW 30 DAYS BETWEEN APPLICATION AND HARVEST.
diclofop-methyl HOE-GRASS 284 (284g/L)	0.71 to 0.796 kg/ha 2.5 to 2.8 L/ha	 1 to 1.12 L/ac	•Use on alfalfa, red or sweet clover when the grass weeds are in the 1 to 4 leaf stage. •DO NOT apply if rain is expected within 1 hour after treatment. •Broadleaf control herbicides must be applied at least 4 days before or after diclofop-methyl. •DO NOT feed forages in the year of seeding after treatment with diclofop-methyl.
fluazifop-p-butyl FUSILADE II (125g/L)	0.1 to 0.25 kg/ha 0.8 to 2 L/ha	 0.32 to 0.8 L/ac	•Use the higher rate (2 L/ha (0.8 L/ac)) when quackgrass is present. •Fluazifop-p-butyl may be tank mixed with 2,4-DB at label rates for control of a broad range of weeds. •Alfalfa may be fed to livestock 41 days after treatment. •DO NOT FEED RED CLOVER OR BIRD'S-FOOT TREFOIL TO LIVESTOCK IN THE YEAR OF TREATMENT.

fluazifop-p-butyl	0.177 kg/ha		•Apply at 2-4 leaf stage of annual grasses and at 3-5 leaf stage quackgrass.
VENTURE 25G (25 DG)	0.7 kg/ha	0.28 kg/ac	•Quackgrass control is improved by preplant tillage to fragment the rhizomes.
plus mineral oil/surfactant			•2,4-DB may be tank mixed for broadleaf weed control.
TURBOCHARGE	0.5 % v/v	0.5 % v/v	•Alfalfa may be fed to lactating dairy animals and other livestock 41 days after treatment.
			•DO NOT FEED RED CLOVER OR BIRD'S-FOOT TREFOIL TO LIVESTOCK IN THE YEAR OF TREATMENT.
sethoxydim	0.15 to 0.2 kg/ha		•Alfalfa is tolerant to sethoxydim at any stage of growth.
POAST ULTRA (450g/L)	0.32 to 0.47 L/ha	0.13 to 0.19 L/ac	•Apply sethoxydim to emerged annual grasses in the 1-6 leaf stage during active growth while the crop is small enough to permit thorough spray coverage.
plus oil concentrate			
ASSIST	2 L/ha	0.8 L/ac	•Complete control is normally obtained 7 to 21 days after application.
or surfactant/solvent			•ALLOW 70 DAYS BETWEEN SPRAYING AND HARVEST.
MERGE	1 L/ha	0.4 L/ac	
sethoxydim	0.5 kg/ha		•Thorough preplant tillage will give more uniform quackgrass emergence.
POAST ULTRA (450g/L)	1.1 L/ha	0.45 L/ac	•Apply at the 1 to 3 leaf stage of actively growing quackgrass.
plus surfactant/solvent			•Gives 6-8 weeks control of quackgrass.
MERGE	1 to 2 L/ha	0.4 to 0.8 L/ac	•ALLOW 70 DAYS BETWEEN SPRAYING AND HARVEST.
2,4-DB	1.1 to 1.4 kg/ha		•Apply in no less than 150 L/ha (60 L/ac) water, when alfalfa, bird's-foot trefoil or clovers are in the 1 to 4 leaf stage.
SEE 2,4-DB (480g/L)	2.3 to 2.9 L/ha	0.92 to 1.16 L/ac	•2,4-DB usually suppresses legume growth for a period of 2 to 3 weeks.
CALIBER 400 (400g/L)	2.75 to 3.5 L/ha	1.1 to 1.4 L/ac	•Under drought, high temperature or other stress conditions, 2,4-DB may severely injure legumes.
COBUTOX 600 (600g/L)	1.8 to 2.3 L/ha	0.72 to 0.92 L/ac	
EMBUTOX 625 (625g/L)	1.75 to 2.25 L/ha	0.7 to 0.9 L/ac	
2,4-DB	0.8 kg/ha		•The addition of MCPA gives better control of common mustard than 2,4-DB alone.
SEE 2,4-DB (480g/L)	1.65 L/ha	0.66 L/ac	•Apply in no less than 150 L/ha (60 L/ac) water.
CALIBER 400 (400g/L)	2 L/ha	0.8 L/ac	•Apply when the legumes are in the 1 to 4 leaf stage.
COBUTOX 600 (600g/L)	1.3 L/ha	0.52 L/ac	
EMBUTOX 625 (625g/L)	1.25 L/ha	0.5 L/ac	
plus MCPA	35 g/ha		
ESTEMINE MCPA (500g/L)	70 mL/ha	28 mL/ac	
bentazon	0.84 to 1.08 kg/ha		•Postemergence treatment for seed production only.
BASAGRAN (480g/L)	1.75 to 2.25 L/ha	0.7 to 0.9 L/ac	•Apply up to the 7 leaf growth stage.
plus oil concentrate			•Apply after third trifoliate stage of legumes and when weeds are small and actively growing.
ASSIST	1 to 2 L/ha	0.4 to 0.8 L/ac	•Top growth of nutsedge and Canada thistle are controlled and field bindweed may be suppressed by 2 applications of 1.75 L/ha (0.7 L/ac), 10 days apart.
			•Cool weather or drought may reduce control.
			•Reduce rate of oil concentrate to 1 L/ha (0.4 L/ac) under abnormally hot and humid weather conditions or temporary crop injury may occur.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
MCPB/MCPA (15:1)	1.1 to 1.7 kg/ha		•Apply when clovers are in the unifoliate to the 4th trifoliate leaf stage.
CLOVITOX PLUS (400g/L)	2.75 to 4.25 L/ha	1.1 to 1.7 L/ac	•Clovers may be suppressed for 2 to 3 weeks.
TROPOTOX PLUS (400g/L)	2.75 to 4.25 L/ha	1.1 to 1.7 L/ac	•Apply TROPOTOX PLUS in no less than 150 L/ha (60 L/ac) of water.
			•For CLOVITOX PLUS:
			•DO NOT apply when temperatures exceed 27 degrees C or under drought conditions.
			•DO NOT graze or cut for forage in the year of application.
			•Do not apply in less than 175 L/ha (70 L/ha) of water.
Forage Legumes (Established)			
fluazifop-p-butyl	0.177 to 0.25 kg/ha		•Apply to regrowth after cutting or growing the forage.
VENTURE 25G (25 DG)	0.7 to 1 kg/ha	0.28 to 0.4 kg/ac	•Quackgrass must be actively growing with 3 to 5 new leaves per shoot for effective control.
plus mineral oil/surfactant			•Alfalfa may be fed to livestock 41 days after treatment.
TURBOCHARGE	0.5 % v/v	0.5 % v/v	•DO NOT FEED RED CLOVER OR BIRD'S-FOOT TREFOIL TO LIVESTOCK IN THE YEAR OF TREATMENT.
propyzamide	1.125 to 1.625 kg/ha		•For grass control only in alfalfa and bird's-foot trefoil.
KERB (50 WP)	2.25 to 3.25 kg/ha	0.9 to 1.3 kg/ac	•Apply in late September to early November before the soil freezes.
			•Do not graze or harvest treated forage within 90 days for the high rate and 60 days for lower rates.
quizalofop-p-ethyl	0.036 to 0.072 kg/ha		•FOR SEED ALFALFA ONLY.
ASSURE II (96g/L)	0.375 to 0.75 L/ha	0.15 to 0.3 L/ac	•Apply to emerged annual grasses and volunteer cereals in the 2 leaf to tillering stage and to quackgrass in the 2 to 6 leaf stage of growth.
plus oil concentrate			
CANPLUS 411 or	5 to 10 L/1000L	5 to 10 L/1000L	•Use the 0.375 L/ha rate (0.15 L/ac) for control of volunteer corn, volunteer cereals and green foxtail.
SURE-MIX	0.5 % v/v	0.5 % v/v	•The 0.5 L/ha (0.2 L/ac) rate provides suppression of quackgrass and will also control barnyard grass.
			•Use the 0.75 L/ha (0.3 L/ac) rate for control of quackgrass.
			•Use the higher rate of CANPLUS 411 when wild oats and quackgrass are the target weeds or under drought conditions.
sethoxydim	0.5 kg/ha		•Apply at the 1 to 3 leaf stage of actively growing quackgrass.
POAST ULTRA (450g/L)	1.1 L/ha	0.45 L/ac	•Apply in 110 to 200 L/ha (44-80 L/ac) water.
plus surfactant/solvent			•Use MERGE at a rate of 1% v/v.
MERGE	1 to 2 L/ha	0.4 to 0.8 L/ac	•Quackgrass control will be provided for 6-8 weeks.
			•ALLOW 70 DAYS BETWEEN SPRAYING AND HARVEST.
[illegible]			
2,4-DB	1.4 to 1.7 kg/ha		•For pure stands or mixtures containing alfalfa or bird's-foot trefoil apply as spot treatment, or when
CALIBER 400 (400g/L)	3.5 to 4.25 L/ha	1.4 to 1.7 L/ac	regrowth after cutting or grazing is not more than 7 cm high.
COBUTOX 600 (600g/L)	2.3 to 2.8 L/ha	0.92 to 1.12 L/ac	•Apply in no less than 150 L/ha (60 L/ac) water.
EMBUTOX 625 (625g/L)	2.25 to 2.75 L/ha	0.9 to 1.1 L/ac	

2,4-DB CALIBER 400 (400g/L) COBUTOX 600 (600g/L) EMBUTOX 625 (625g/L)	1.4 kg/ha 3.5 L/ha 2.3 L/ha 2.25 L/ha	 1.4 L/ac 0.92 L/ac 0.9 L/ac	•Apply to actively growing weeds in September or October when regrowth after cutting or grazing is no more than 7 cm high. •Apply in no less than 150 L/ha (60 L/ac) water.
MCPB/MCPA (15:1) TROPOTOX PLUS (400g/L)	1.7 kg/ha 4.25 L/ha	 1.7 L/ac	•For pure stands or mixtures containing red and alsike clovers. •Apply as spot treatment, or when regrowth after cutting or grazing is not more than 7 cm high. •Apply in no less than 150 L/ha (60 L/ac) water.
amitrole AMITROL 240 (231g/L)	3 to 4 kg/ha 12.5 to 16.5 L/ha	 5 to 6.6 L/ac	•Apply after the final harvest in the final year of the forage. •Apply when thistle regrowth is 10 to 15 cm tall. •Wait 2 weeks before plowing. •DO NOT graze or otherwise harvest the forage after spraying.
glyphosate ROUNDUP TRANSORB (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	1.71 to 4.32 kg/ha 4.75 to 12 L/ha 1.56 to 3.96 kg/ha 4.75 to 12 L/ha	 1.7 to 4.8 L/ac 1.7 to 4.8 L/ac	•Apply as spot treatment when the field bindweed has reached full bloom and other weeds are in the bud to full bloom stage. •DO NOT graze or harvest forage from treated spots until the treated plants turn brown. •DO NOT GRAZE OR HARVEST FORAGE FROM AREAS TREATED WITH TOUCHDOWN.
imazethapyr PURSUIT (240g/L) plus non-ionic surfactant plus liquid fertilizer (10-34-0, 28-0-0 or 32-0-0)	0.075 to 0.1 kg/ha 0.312 to 0.42 L/ha 0.25 % v/v 2 L/ha	 0.125 to 0.168 L/ac 0.25 % v/v 0.8 L/ac	•FOR SEED ALFALFA ONLY. •One application per year. Apply early postemergence when weeds are less than 7.5 cm (3 in.) tall. •Apply in 200 L/ha (80 L/ac) water. •Apply only after the crop has one fully developed trifoliate leaf.
paraquat GRAMOXONE (200g/L)	0.56 to 1.1 kg/ha 2.8 to 5.5 L/ha	 1.12 to 2.2 L/ac	•Apply to trefoil seed fields when the crop is about 15 cm high in the spring. •Apply to alfalfa or trefoil forage fields within 5 days after cutting. •Slow recovery and some stand reduction has been observed under conditions of drought or high temperatures. •DO NOT use in the spring after treatment with simazine.
simazine SIMADEX (500g/L) PRINCEP NINE-T (90WG) SIMAZINE 80W (80 WP)	1.1 kg/ha 2.2 L/ha 1.22 kg/ha 1.38 kg/ha	 0.88 L/ac 0.49 kg/ac 0.55 kg/ac	•DO NOT use SIMADEX on alfalfa. •Apply in September to November before freeze up. •This treatment will also prevent legume seedlings from establishing for approximately 8 months. •DO NOT use in the fall before seeding another crop. •DO NOT apply paraquat within 1 year after simazine application. •DO NOT apply to the same field for more than 3 consecutive years. •Allow 30 days between applications and grazing cattle or sheep.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
glyphosate ROUNDUP TRANSORB (360g/L)	0.9 to 1.8 kg/ha 2.5 to 5 L/ha	 1 to 2 L/ac	Apply 3-7 days prior to last cut in the final year of the forage. Forage can be harvested as hay, haylage or grazed.

Pasture Renovation with Bird's-foot Trefoil

The introduction of this legume into a pasture requires control of competition from weeds and forage grasses for the first 2 to 4 months after the legume seed begins to germinate. Control of established perennial weeds should start at least one year before the legume seeding operation, using treatments recommended in the previous section of this publication. If the field cannot be plowed and worked to prepare a seedbed, one of the following chemical treatments can be used to suppress the sod.

The success of these programs depends on many management factors such as inoculation of the trefoil seed, and control of fertility and grazing. Consult local agricultural authorities for more information about pasture renovation.

glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360 g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	1.71 to 4.32 kg/ha 4.75 to 12 L/ha 4.75 to 12 L/ha 1.567 to 3.96 kg/ha 4.75 to 12 L/ha	 1.9 to 4.8 L/ac 1.9 to 4.8 L/ac 1.9 to 4.8 L/ac	•Apply when the forage grasses have at least 2 leaves.
paraquat GRAMOXONE (200g/L)	1.1 kg/ha 5.5 L/ha	 2.2 L/ac	•Broadcast seed and fertilizer in mid-April. •Apply paraquat in early May when the grass is 5-10 cm high before the legume seed germinates.

Pastures (Mostly Grasses)

Biennials: Most chemicals are best applied in early fall to first year growth or in late spring to second year growth, unless otherwise noted.
Perennials: Apply in late spring (end of May to mid June) when weeds are actively growing unless otherwise noted.

Overgrazing tends to thin the grass stand and allows the establishment of weeds. Undergrazing allows weeds like wild carrot to form and spread seed. Timely mowing can prevent the ripening of weed seeds and reduce the distance these seeds spread with the wind.

Chemicals are available to control most of the troublesome weeds in grass pastures and these can give faster kill of established weeds than any other management practice. A chemical may have to be applied more than once to kill established perennial weeds and the new crop of weeds that emerges through a thin grass stand. A poor grass stand can be improved by using a combination of chemicals, fertility and grazing management.

Chemical weed control should extend into fencerows and other areas around the pasture to keep these areas from becoming sources of weed seeds.

Generally, clovers are severely damaged by chemical treatments. However, white clover and black medic show some resistance or re-establish quickly.

CONSULT THE LABEL IN REGARD TO THE PERIOD OF TIME TO KEEP LIVESTOCK OUT OF THE TREATED AREA.

Care should be taken to prevent grazing where poisonous plants (water hemlock, buttercup, chokecherry, etc.) may be made more attractive to livestock after the chemical treatment. It is a good practice to prevent grazing on the field for at least a week after spraying to reduce the chances of the livestock picking up harmful plants.

Apply chemical treatments in at least 200 L/ha (80 L/ac) water and increase this rate if it is necessary to contact weeds through a thick volume of vegetation.

2,4-D * 2,4-D (470g/L)	0.85 kg/ha 1.8 L/ha	 0.72 L/ac	•For chicory.
2,4-D * 2,4-D (470g/L)	0.85 to 1.1 kg/ha 1.8 to 2.34 L/ha	 0.72 to 0.94 L/ac	•For yellow rocket: Mow before spraying if plants are in flowering stage.
2,4-D * 2,4-D (470g/L)	1.01 kg/ha 2.15 L/ha	 0.86 L/ac	•For goldenrod.
2,4-D * 2,4-D (470g/L)	1.1 kg/ha 2.34 L/ha	 0.94 L/ac	•Blueweed and burdock: apply as low volatile ester. •Wild carrot: Early spring or early fall. If 2,4-D resistant strains are present, mow to reduce seed spread. •Goat's-beard: Early spring or early fall. •Milkweed: spray undersides of leaves. Only top growth is killed. •Water hemlock: Apply in May or June. •Dandelion: Can also apply in September
2,4-D * 2,4-D (470g/L)	1.1 to 1.75 kg/ha 2.34 to 3.72 L/ha	 0.94 to 1.49 L/ac	•For ox-eye daisy and hawk's-beard: Use 2 treatments, one in late spring and the second in early September if there is sufficient growth.
2,4-D * 2,4-D (470g/L)	2.25 kg/ha 4.5 L/ha	 1.8 L/ac	•For tansy ragwort. Apply to rosettes in spring or fall. Retreat as necessary to control new seedlings and regrowth.
2,4-D * 2,4-D (470g/L) plus dicamba BANVEL II (480g/L)	1.1 kg/ha 2.34 L/ha 1.01 kg/ha 2.1 L/ha	 0.94 L/ac 0.84 L/ac	•For wild carrot. Apply in early fall for control of first year plants. •Wait 14 days between treatment and harvest or grazing for dairy animals. •Meat animals may graze or feed in treated pastures 30 days after dicamba application without restrictions on slaughter. •If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with untreated diet for 30 days before slaughter.
2,4-DB CALIBER 400 (400g/L) COBUTOX 600 (600g/L) EMBUTOX 625 (625g/L)	1.72 kg/ha 4.25 L/ha 2.8 L/ha 2.75 L/ha	 1.7 L/ac 1.12 L/ac 1.1 L/ac	•For nodding, Scotch or bull thistle.
amitrole AMITROL 240 (231g/L)	0.038 to 0.106 kg/10L 0.165 to 0.46 L/10L		•Lower rate for dandelion, Canada thistle, sow-thistle, hoary cress, milkweed, poison-ivy, and toadflax. •Higher rate for horsetail and leafy spurge. •Use spot treatments. •Spray to wet before flowering. •Keep animals away from treated area for 6 to 8 months.
dicamba BANVEL II (480g/L)	0.6 kg/ha 1.25 L/ha	 0.5 L/ac	•For leafy and cypress spurges: for control of top growth, apply when weed is actively growing. •No delay is required between treatment and harvest or grazing for dairy animals. •Meat animals may consume graze or be fed treated pastures 30 days after dicamba application without restrictions on slaughter. •If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with an untreated diet for 30 days before slaughter.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
dicamba BANVEL II (480g/L)	1.01 kg/ha 2.1 L/ha	0.84 L/ac	•For tansy ragwort: apply when weed is actively growing. •Wait 7 days between treatment and harvest or grazing for dairy animals. •Meat animals may consume graze or be fed treated pastures 30 days after dicamba application without restrictions on slaughter. •If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with an untreated diet for 30 days before slaughter.
dicamba BANVEL II (480g/L)	1.1 kg/ha 2.29 L/ha	0.92 L/ac	•For goldenrod: apply when weed is actively growing. •Wait 14 days between treatment and harvest or grazing for dairy animals. •Meat animals may consume graze or be fed treated pastures 30 days after dicamba application without restrictions on slaughter. •If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with an untreated diet for 30 days before slaughter.
dicamba BANVEL II (480g/L)	1.2 kg/ha 2.5 L/ha	1 L/ac	•For Canada thistle and field bindweed: apply at bud stage of thistle and at flowering of bindweed. •Wait 14 days between treatment and harvest or grazing for dairy animals. •Meat animals may consume graze or be fed treated pastures 30 days after dicamba application without restrictions on slaughter. •If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with an untreated diet for 30 days before slaughter.
dicamba BANVEL II (480g/L)	2.212 kg/ha 4.6 L/ha	1.84 L/ac	•For goat's-beard: apply when actively growing. •Wait 14 days between treatment and harvest or grazing for dairy animals. •Meat animals may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter. •If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with untreated diet for 30 days before slaughter.
glyphosate ROUNDUP TRANSORB (360g/L)	1.71 to 2.52 kg/ha 4.75 to 7 L/ha	1.9 to 2.8 L/ac	•For colt's-foot: apply as spot treatment when colt's-foot leaves are fully expanded. •Wait until the treated areas have turned brown before grazing.
glyphosate ROUNDUP TRANSORB (360g/L)	2.52 to 4.32 kg/ha 7 to 12 L/ha	2.8 to 4.8 L/ac	•For tansy: apply as spot treatment when tansy is in bud to full bloom stage.
glyphosate ROUNDUP TRANSORB (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	1.71 to 4.32 kg/ha 4.75 to 12 L/ha 1.567 to 3.96 kg/ha 4.75 to 12 L/ha	1.9 to 4.8 L/ac 1.9 to 4.8 L/ac	•For Canada thistle, field bindweed and milkweed. •Always use high rate for milkweed. •Apply as spot treatment when thistle and milkweed are in the bud to full bloom stage and bindweed is flowering. •Wait until the treated areas have turned brown before grazing. •DO NOT GRAZE OR HARVEST FORAGE FROM AREAS TREATED WITH TOUCHDOWN.
MCPA ESTEMINE MCPA (500g/L)	1.1 kg/ha 2.2 L/ha	0.88 L/ac	•For buttercup: use 2 treatments, one in June and the second in early September. •Wait 7 days after treatment before grazing.

MCPB/MCPA	1.7 kg/ha		•This treatment has some safety on legumes.
CLOVITOX PLUS (400g/L)	4.25 L/ha	1.7 L/ac	•Controls top growth of weeds only.
TROPOTOX PLUS (400g/L)	4.25 L/ha	1.7 L/ac	•Canada thistle: Apply when 15 cm high to early bud stage.
			•Curled dock, plantains, sow thistle: Apply to rosette stage.
			•Buttercup and field bindweed: Apply in spring.
			•Horsetail: Apply when 15 cm high.
			•DO NOT apply CLOVITOX PLUS when temperature exceeds 27 degrees C or under drought conditions.
			•DO NOT graze CLOVITOX treated pasture or harvest for forage in year of application.
			•DO NOT apply CLOVITOX PLUS in less than 175 L/ha (70 L/ac) of water.
			•DO NOT apply TROPOTOX PLUS in less than 150 L/ha (60 L/ac) of water.

Stages of Alfalfa, Red Clover Ladino, Aslike and Black Medic Leaf Development

Unifoliate 1 Trifoliate 2 Trifoliate 3 Trifoliate

Stages of Bird's-Foot Trefoil Leaf Development

1 Trifoliate 2 Trifoliate 3 Trifoliate

Notes:

Weed control ratings are given as 0-9 where 0 indicates no control and 9 indicates 90%-100% control under ideal conditions.

Ratings are subjective values based on best available information and give general comparisons based on use as descibed in this guide.

Under unfavorable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used.

Ratings in **BOLD** suggest the weed is listed on the product label for control or suppression.

Please see product label for more information on registered weed species, product uses and precautions.

Table 12. Forages Herbicide Weed Control Ratings

Treatment	Trade Name	Crop							Grasses							Annual Broadleaves											Perennials										
		seedling alfalfa	seedling birdsfoot trefoil	seedling clovers	established alfalfa	established birdsfoot trefoil	established clovers	forage grasses and grass pasture	barnyard grass	crabgrass	fall panicum	foxtail, green	foxtail, yellow	old witch grass	wild oats	buckwheat, wild	chickweed,common	cleavers	corn spurry	hempnettle	lady's thumb	lamb's-quarters	mustards	pigweeds	ragweed	velvetleaf	bindweed, field	chickweed, mouseeared	curled dock	dandelion	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
soil applied grass herbicides																																				
EPTC	EPTAM	✓	✓						**9**	**9**	**9**	**9**	**9**	**?**	**?**	**6**	**7**	?	**?**	?	7	**9**	6	**9**	2	?	?	?	0	0	0	0	**8**	**2**	0	0
trifluralin	TREFLAN, RIVAL, BONANZA	✓							**9**	**9**	9	**9**	**9**	9	**8**	**5**	**?**	?	?	?	5	2	**8**	2	**8**	2	3	?	?	0	0	0	0	0	0	0	0
post emergent grass herbicides																																				
clethodim	SELECT	✓							**9**	**8**	**9**	**9**	**9**	**9**	**?**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**7**	0	0
dichlofop-methyl	HOE-GRASS 284	✓		✓					**9**	**8**	**9**	**9**	**9**	**9**	**?**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
fluazifop-p-butyl	FUSILADE II, VENTURE	✓	✓	✓	✓	✓	✓		**9**	**8**	**9**	**8**	**8**	**9**	**9**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	0	0
propyzamide	KERB				✓	✓			**8**	**8**	**6**	**8**	**8**	**?**	**?**	**?**	**8**	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	**8**	0	0
quizalofop-p-ethyl	ASSURE II [1]				✓				**9**	8	9	**9**	9	9	**?**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	0	0
sethoxydim	POAST ULTRA	✓	✓	✓	✓	✓	✓		**9**	**8**	**9**	**9**	**9**	**9**	**8**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**6**	0	0
post emergent broadleaf herbicides																																				
2,4-D *	2,4-D*							✓	0	0	0	0	0	0	0	**7**	**8**	?	?	?	**7**	**9**	**9**	**9**	**9**	**9**	**?**	?	**7**	**8**	**?**	0	0	0	**8**	**8**
2,4-DB *	2,4-DB*, CALIBER, COBUTOX, EMBUTOX [2,3]	✓	✓	✓	✓	✓	✓	✓	0	0	0	0	0	0	0	**8**	8	?	?	?	?	**7**	**8**	**9**	**9**	?	**8**	?	?	?	?	?	0	0	8	**8**
bentazon	BASAGRAN	✓			✓				0	0	0	0	0	0	0	7	**?**	?	**?**	?	**9**	**8**	**9**	**7**	**8**	**9**	**5**	?	?	?	?	2	**8**	0	6	**7**
dicamba	BANVEL II							✓	0	0	0	0	0	0	0	**8**	?	?	?	?	**9**	**9**	**7**	**7**	9	**9**	**8**	?	9	8	?	0	0	0	**9**	**8**
MCPA*	MCPA*							✓	0	0	0	0	0	0	0	**4**	**?**	?	?	**8**	**?**	**9**	**9**	**8**	**8**	**8**	**7**	**?**	?	**?**	8	?	0	0	**6**	**5**
MCPB/MCPA(15:1)	TROPOTOX PLUS, CLOVITOX PLUS [4]			✓			✓	✓	0	0	0	0	0	0	0	2	2	?	?	**8**	?	**9**	**9**	**9**	**8**	**9**	**8**	?	?	?	**?**	?	0	0	**9**	**9**

Table 12. Forages Herbicide Weed Control Ratings

Treatment	Trade Name	Crop						Grasses							Annual Broadleaves										Perennials									
		seedling alfalfa	seedling birdsfoot trefoil	seedling clovers	established alfalfa	established birdsfoot trefoil	established clovers	forage grasses and grass pasture	barnyard grass	crabgrass	fall panicum	foxtail, green	foxtail, yellow	old witch grass	wild oats	buckwheat, wild	chickweed,common	cleavers	corn spurry	hempnettle	lady's thumb	lamb's-quarters	mustards	pigweeds	ragweed	velvetleaf	bindweed, field	chickweed, mouseeared	curled dock	dandelion	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
post emergent grass and broadleaf herbicides																																		
imazethapyr	PURSUIT [1]				✓				**8**	**7**	7	**9**	**9**	**8**	8	**8**	?	?	?	?	**9**	**9**	**9**	**9**	**8**	**9**	2	?	?	?	2	2	4	5	2	2
paraquat	GRAMOXONE				✓	✓			8	**7**	**9**	**9**	**9**	?	?	**9**	**9**	?	?	?	**9**	**8**	**9**	**9**	**9**	?	?	?	0	0	?	0	0	**5**	0	0
simazine	PRINCEP NINE-T, SIMADEX, SIMAZINE [5]				✓	✓	✓		**6**	**8**	8	?	**8**	**8**	**9**	**9**	?	?	?	?	**9**	**9**	9	9	**8**	6	7	?	?	?	?	?	?	6	?	?

* Various formulations available, see Table 1.

? Insufficient information available to make a rating

[1] For seed crops only

[2] Do not use on sweet clover

[3] On established legumes, use fall spot treatment only

[4] CLOVITOX PLUS not for established clovers

[5] SIMADEX not for alfalfa

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
Peanuts			
PREPLANT - See under **PREPLANT - SITE PREPARATION** for details of products, rates and remarks.			
bentazon **BASAGRAN** (480g/L) plus oil concentrate **ASSIST**	1.08 kg/ha 2.25 L/ha 2 L/ha	 0.9 L/ac 0.8 L/ac	Apply when peanuts are in the unifoliate to 4th trifoliate leaf stage and when weeds are small and actively growing. Many annual broadleaf weeds including velvetleaf (15 cm/up to 6 leaf), smartweed (20 cm/up to 10 leaf) and cocklebur (30 cm/up to 10 leaf) are controlled. Top growth of Canada thistle and yellow nutsedge is controlled and field bindweed may be suppressed but 2 applications of **BASAGRAN** at 1.75 L/ha (0.7 L/ac) 10 days apart may be required. A new flush of weeds may emerge after the first flush has been controlled. Temporary crop injury may occur under abnormally cool or hot, humid conditions. Reduce rate of oil concentrate to 1 L/ha (0.4 L/ac) when those conditions occur. Cool weather or drought may delay or reduce control.
Soybeans			
All treatments should be applied in 150 to 300 L/ha (60-120 L/ac) water unless otherwise specified. Equipment used to apply DICAMBA (BANVEL II), 2,4-D MCPA, MCPB, MCPB/MCPA, 2,4-DB, KIL-MOR, or related herbicides should be thoroughly cleaned up immediately after use as well as before it is used to spray soybeans. See "Cleaning the Sprayer" section. Total Weed Control System- Although herbicides themselves may be effective, there is benefit in using all the various weed control methods available to obtain the best weed control possible. Crop rotation, herbicide rotation, early weed control with a rotary hoe, harrowing, cultivating and preventing the spread of weeds as much as possible are all a part of weed management. See the corn section for some details of each of these methods. Triazine Residues- When soybeans follow corn treated with triazines such as atrazine or simazine the previous year, and if triazine residues remain they may interact with a number of herbicides used for weed control in soybeans to cause crop injury. Examples of soybean herbicides which may be involved include the triazine based herbicide metribuzin (SENCOR or LEXONE) or the substituted urea herbicides (AFOLAN, AFESIN, LINURON EC, LOROX or PATORAN). The substituted urea herbicides are of less concern in this regard. The potential for injury is greater during adverse weather conditions, in shorter season soybean growing areas and/or in soils with a high pH. Herbicide injury symptoms should not be confused with cold injury symptoms. Also see "Notes on Atrazine and Simazine Soil Residues" which appears at the start of the corn section in this publication. RESISTANT WEEDS - Biotypes of a number of weeds have been found resistant to Group 5 (triazine) and Group 2 herbicides. Refer to the section "Managing Weed Resistance to Herbicides" for management and control strategies for these weeds. Specific Weeds- For information on specific weeds see the Soybean Herbicide Weed Control Ratings Table. Then refer to the appropriate section for details about herbicide treatments. **PREPLANT** - See under **PREPLANT - SITE PREPARATION** for details of products, rates and remarks. **PREPLANT INCORPORATED** - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last. **PREEMERGENCE** - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.			

dimethenamid FRONTIER (900g/L)	1 to 1.25 kg/ha 1.1 to 1.4 L/ha	0.44 to 0.56 L/ac	•Tank-mix with metribuzin and/or follow with sequential preemergence herbicide for additional broadleaf weed control. •Apply preplant or preplant incorporated with the incorporation equipment set no deeper than 10 cm (4 inches) or preemergence. •Use higher rate of FRONTIER for the control of nightshade and pigweed (PPI or PRE only). •Control of nutsedge is achieved by applying FRONTIER preplant incorporated. •Preplant applications registered in tankmix combinations only (See Soil Applied Tankmix Options). •Minimum rate for preplant incorporated treatments is 0.5 L/ac.
ethalfluralin EDGE (60 DC)	0.66 to 1.14 kg/ha 1.1 to 1.9 kg/ha	0.44 to 0.76 kg/ac	•Vigorous, continuous agitation is essential for mixing. All in line screens should be 50 mesh or coarser. •Apply preplant incorporated. •The first incorporation should be done as soon as possible after application but may be delayed up to 8 to 24 hours. The second incorporation is recommended anytime before planting.
s-metolachlor DUAL MAGNUM (915g/L)	1.05 to 1.6 kg/ha 1.15 to 1.75 L/ha	0.46 to 0.7 L/ac	•DO NOT use on muck, peat or high organic matter soils. •Apply preplant or preplant incorporated or preemergent. •Use the higher rate of (DUAL MAGNUM) for heavier weed populations. •Control of yellow nutsedge is obtained when DUAL MAGNUM is applied preplant incorporated. •Optimal control of nightshade is obtained when DUAL MAGNUM is applied pre-emergent. •Incorporation depth should not exceed 10 cm. •Preplant applications registered in tankmix combinations only (See Soil Applied Tankmix Option section for information on registered tankmixes and rates).
trifluralin TREFLAN (480 g/L) RIVAL DF (60 DF) BONANZA 400 (400g/L)	0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1 to 1.91 kg/ha 1.5 to 2.75 L/ha	 0.5 to 0.96 L/ac 0.4 to 0.76 kg/ac 0.6 to 1.1 L/ac	•The first incorporation should be done as soon as possible after application but may be delayed up to 8 to 24 hours. The second incorporation is recommended anytime before planting. •Apply preplant incorporated
linuron AFOLAN F (480g/L) or linuron LOROX DF (50 DF) LINURON 480 (480g/L)	0.86 to 2.25 kg/ha 1.79 to 4.68 L/ha 1.13 to 2.25 kg/ha 2.26 to 4.5 kg/ha 2.25 to 4.5 L/ha	 0.72 to 1.87 L/ac 0.9 to 1.8 kg/ac 0.9 to 1.8 L/ac	•DO NOT use on sands (less than 2% to 3% organic matter, •Seed beans at least 4 cm deep. •Heavy rainfall and adverse weather conditions may result in temporary crop injury. •Use higher rate for muck soils and clay soils. •Apply preemergent. •Lorox DF can be applied as preplant tankmixes at a reduced rate (0.68-0.8 kg/ha) (See soil applied tankmix options).
metobromuron PATORAN FL (400g/L)	1 to 2.25 kg/ha 2.50 to 5.63 L/ha	 1 to 2.25 L/ac	•DO NOT use on sands (less than 2% to 3% organic matter). •Apply preemergent. •Seed beans at least 4 cm deep. •Heavy rainfall and adverse weather conditions may result in temporary crop injury. •Use higher rate for muck soils and clay soils.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
metribuzin LEXONE DF (75 DF) SENCOR 75 DF (75 WG)	0.56 to 1.12 kg/ha 0.75 to 1.5 kg/ha 0.75 to 1.5 kg/ha	 0.3 to 0.6 kg/ac 0.3 to 0.6 kg/ac	•DO NOT use on sandy or coarse soils with less than 2% organic matter. •Use the recommended rate for each soil types (see label), otherwise crop injury may occur. •Excessive rainfall and adverse weather conditions may result in crop injury. •DO NOT use on metribuzin sensitive varieties. See "Ontario Soybean Variety Trials" brochure. •Plant beans at least 4 cm deep. •Apply preplant or preplant incorporated or preemergent. •Preplant incorporated applications registered in tankmix combination only (See Soil Applied Tankmix Option section for information on registered tankmixes and rates). •For preplant applications - apply up to 30 days prior to seeding the crop. - avoid moving treated soil out of the row area or bringing up untreated soil during seeding operations or weed control may be reduced. - use the higher rate when weeds are dense and are on soils with high organic matter (over 4%) and on soils with high clay content. - if emerged weeds are taller than 4 cm, apply in tankmix with glyphosate. •Some rotational cropping restrictions apply (see "Notes on Chemicals").
monolinuron AFESIN (200g/L)	1.7 to 1.95 kg/ha 8.5 to 9.75 L/ha	 3.4 to 3.9 L/ac	•DO NOT use on sandy soils (3% organic matter or less). •Heavy rainfall and adverse weather conditions may result in crop injury, which is usually of a temporary nature. •Beans should be seeded at least 4 cm deep. •Apply preemergent.
[illegible] and Preplant Herbicides			
flumetsulam/metolachlor BROADSTRIKE DUAL (923g/L)	2.215 kg/ha 2.4 L/ha	 0.96 L/ac	•DO NOT apply to areas where the soil pH is >7.8 and organic matter < 2%. •Apply preplant, or preplant incorporated or preemergent. •DO NOT apply to soils containing more than 5% organic matter. •Sufficient rainfall to moisten the soil to a depth of 5 cm should be received within 7 to 10 days for optimum weed control •For ppi treatments uniformly incorporate with equipment set to work at a depth of 5-8 cm. •For preplant treatments in minimum or no-till systems apply up to 21 days before planting. • DO NOT move treated soil out of the row or move untreated soil to the surface during planting or weed control will be diminished. •Suspension concentrate formulation separates into two phases over time. Shake container before using. •Some rotational cropping restrictions apply (see "Notes on Chemicals").

flumetsulam/trifluralin BROADSTRIKE TREFLAN (438g/L)	1.022 kg/ha 2.33 L/ha	0.93 L/ac	•Must be incorporated within 24 hours after application. Uniformly incorporate with equipment set to work at a depth of 5-8 cm. •For heavy weed infestations or coarse textured soils a second incorporation is recommended. •DO NOT apply to natto soybean varieties. •DO NOT apply to areas where the soil pH is > 7.8 and organic matter < 2%. •DO NOT apply to soils containing more than 5% organic matter. •Suspension concentrate formulation separates into two phases over time. Shake container before using. •Apply preplant incorporated. •Some rotational cropping restrictions apply (see "Notes on Chemicals").
imazethapyr PURSUIT (240g/L)	0.075 to 0.1 kg/ha 0.312 to 0.42 L/ha	0.125 to 0.168 L/ac	•Apply preplant, or preplant incorporated or preemergent. •Some rotational cropping restrictions apply (see "Notes on Chemicals"). •Addition of non-ionic surfactant and liquid fertilizer is required if emerged weeds are present at application. •For preplant applications - apply Pursuit at .168L/ac - apply up to 30 days prior to planting - For minimum tillage, only one working of the soil to prepare a seedbed is recommended following application. This final seedbed preparation should not be deeper than 10 cm and should not turn untreated soil to the surface. •For preplant incorporated applications apply Pursuit at .125L/ac. •For preemergent applications heavy infestations of, ragweed and/or barnyard grass require a tank-mix. •For preplant incorporated applications heavy infestations of lamb's-quarters, ragweed or barnyard grass may require a tankmix. •DO NOT apply as preplant incorporated application more than one year in sequence. •Use only once per season.
imazethapyr + metribuzin CONQUEST (CONQUEST B(70SG) + CONQUEST A(75WG))	0.075 + 0.425 kg/ha 0.107 + 0.567 kg/ha	0.043 + 0.23 kg/ac	•CONQUEST is only available in a package containing both imazethapyr and metribuzin. •For use on medium and heavy textured soils only. •Apply preplant incorporated or preemergent. •See Pursuit for additional comments. •DO NOT use on metribuzin sensitive varieties. See "Ontario Soybean Variety Trials" brochure.
imazethapyr/pendimethalin VALOR ((1:14.5)342g/L)	1.165 kg/ha 3.4 L/ha	1.36 L/ac	•Allow 24 months between applications. •Can only be applied preplant incorporated. •See Pursuit for additional comments. •Refer to Notes on Chemicals for rotation restrictions for each component.
dimethenamid FRONTIER (900g/L) plus glyphosate ROUNDUP (356g/L)	1 to 1.25 kg/ha 1.1 to 1.4 L/ha 0.89 kg/ha 2.5 L/ha	0.44 to 0.56 L/ac 1 L/ac	•Apply preplant

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
dimethenamid	1 to 1.25 kg/ha		•Apply preemergent
FRONTIER (900g/L)	1.1 to 1.4 L/ha	0.44 to 0.56 L/ac	
plus imazethapyr	0.075 to 0.1 kg/ha		
PURSUIT (240g/L)	0.312 to 0.42 L/ha	0.125 to 0.168 L/ac	
dimethenamid	1 to 1.25 kg/ha		•Apply preemergent
FRONTIER (900g/L)	1.11 to 1.4 L/ha	0.44 to 0.56 L/ac	
plus linuron	0.91 to 1.15 kg/ha		
LOROX DF (50 DF)	1.9 to 2.3 kg/ha	0.76 to 0.92 kg/ac	
AFOLAN F (480g/L)	1.9 to 2.3 L/ha	0.76 to 0.92 L/ac	
dimethenamid	1.125 to 1.25 kg/ha		•Apply preplant incorporated
FRONTIER (900g/L)	1.25 to 1.4 L/ha	0.5 to 0.56 L/ac	
plus metribuzin	0.413 to 0.48 kg/ha		
LEXONE DF (75 DF)	0.54 to 0.64 kg/ha	0.22 to 0.26 kg/ac	
or plus metribuzin	0.4 to 0.502 kg/ha		
SENCOR 75 DF (75 WG)	0.55 to 0.75 kg/ha	0.22 to 0.3 kg/ac	
dimethenamid	1 to 1.25 kg/ha		•Apply preemergent
FRONTIER (900g/L)	1.1 to 1.4 L/ha	0.44 to 0.56 L/ac	
plus metribuzin	0.409 to 0.566 kg/ha		
LEXONE DF (75 DF)	0.54 to 0.75 kg/ha	0.22 to 0.3 kg/ac	
SENCOR 75 DF (75 WG)	0.54 to 0.75 kg/ha	0.22 to 0.3 kg/ac	
dimethenamid	1 to 1.25 kg/ha		•Apply preemergent
FRONTIER (900g/L)	1.1 to 1.4 L/ha	0.44 to 0.56 L/ac	
plus metribuzin	0.36 to 0.56 kg/ha		
LEXONE DF (75 DF)	0.48 to 0.75 kg/ha	0.19 to 0.3 kg/ac	
SENCOR 75 DF (75 WG)	0.48 to 0.75 kg/ha	0.19 to 0.3 kg/ac	
plus linuron	0.7 to 1 kg/ha		
LOROX DF (50 DF)	1.4 to 2 kg/ha	0.56 to 0.8 kg/ac	
AFOLAN F (480g/L)	1.5 to 2.1 L/ha	0.6 to 0.84 L/ac	
ethalfluralin	0.7 to 1.1 kg/ha		•Apply preplant incorporated
EDGE (60 DC)	1.17 to 1.84 kg/ha	0.47 to 0.74 kg/ac	
plus metribuzin	0.350 to 0.526 kg/ha		
LEXONE DF (75 DF)	0.47 to 0.7 kg/ha	0.19 to 0.28 kg/ac	
SENCOR 75 DF (75 WG)	0.47 to 0.7 kg/ha	0.19 to 0.29 kg/ac	
flumetsulam/metolachlor	2.22 kg/ha		•Apply preplant
BROADSTRIKE DUAL (923g/L)	2.4 L/ha	0.96 L/ac	
plus glyphosate	0.89 kg/ha		
ROUNDUP (356g/L)	2.5 L/ha	1 L/ac	
or glyphosate TMS	0.83 kg/ha		
TOUCHDOWN 480 (330g/L)	2.5 L/ha	1 L/ac	

imazethapyr	0.075 kg/ha		•Apply preplant incorporated
PURSUIT (240g/L)	0.312 L/ha	0.125 L/ac	
metribuzin	0.405 to 0.56 kg/ha		
LEXONE DF (75 DF)	0.54 to 0.74 kg/ha	0.22 to 0.3 kg/ac	
metribuzin	0.41 to 1.13 kg/ha		
SENCOR 75 DF (75 WG)	0.55 to 1.5 kg/ha	0.22 to 0.6 kg/ac	
imazethapyr	0.075 kg/ha		•Apply preplant incorporated
PURSUIT (240g/L)	0.312 L/ha	0.125 L/ac	
plus ethalfluralin	0.66 to 1.14 kg/ha		
EDGE (60 DF)	1.1 to 1.9 kg/ha	0.44 to 0.76 kg/ac	
imazethapyr	0.1 kg/ha		•Apply preplant
PURSUIT (240g/L)	0.42 L/ha	0.168 L/ac	
plus glyphosate	0.836 to 0.89 kg/ha		
ROUNDUP (356g/L)	2.35 to 2.5 L/ha	0.94 to 1 L/ac	
or glyphosate TMS	0.77 to 0.83 kg/ha		
TOUCHDOWN 480 (330g/L)	2.35 to 2.5 L/ha	0.94 to 1 L/ac	
imazethapyr	0.075 to 0.1 kg/ha		•Apply preemergence
PURSUIT (240g/L)	0.312 to 0.42 L/ha	0.125 to 0.168 L/ac	
plus linuron	0.85 to 1.15 kg/ha		
LOROX DF (50 DF)	1.7 to 2.3 kg/ha	0.68 to 0.92 kg/ac	
AFOLAN F (480g/L)	1.77 to 2.39 L/ha	0.71 to 0.96 L/ac	
LINURON 480 (480g/L)	1.77 to 2.39 L/ha	0.71 to 0.96 L/ac	
imazethapyr	0.075 to 0.1 kg/ha		•Apply preemergent
PURSUIT (240g/L)	0.31 to 0.42 L/ha	0.125 to 0.168 L/ac	
plus metribuzin	0.4 to 0.48 kg/ha		
LEXONE DF (75 DF)	0.53 to 0.64 kg/ha	0.21 to 0.26 kg/ac	
or plus metribuzin	0.4 to 0.85 kg/ha		
SENCOR 75 DF (75 WG)	0.53 to 1.13 kg/ha	0.21 to 0.45 kg/ac	
imazethapyr	0.1 kg/ha		•Apply preplant.
PURSUIT (240g/L)	0.42 L/ha	0.168 L/ac	•See paraquat instructions in the "Preplant Site Preparation" section for details.
plus paraquat	0.55 to 1.1 kg/ha		
GRAMOXONE (200g/L)	2.75 to 5.5 L/ha	1.1 to 2.2 L/ac	
imazethapyr	0.075 kg/ha		•Apply preplant incorporated
PURSUIT (240g/L)	0.312 L/ha	0.125 L/ac	
plus trifluralin	0.6 to 1.155 kg/ha		
TREFLAN (480g/L)	1.25 to 2.4 L/ha	0.5 to 0.96 L/ac	
RIVAL DF (60 DF)	1 to 1.91 kg/ha	0.4 to 0.76 kg/ac	
BONANZA 400 (400g/L)	1.5 to 2.75 L/ha	0.6 to 1.1 L/ac	

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
metolachlor	1.68 to 2.64 kg/ha		•Apply preplant
DUAL (960g/L)	1.75 to 2.75 L/ha	0.7 to 1.1 L/ac	
plus glyphosate TMS	0.77 to 0.83 kg/ha		
TOUCHDOWN 480 (330g/L)	2.35 to 2.5 L/ha	0.9 to 1 L/ac	
metolachlor	1.68 to 2.64 kg/ha		•Apply preemergent
DUAL (960g/L)	1.75 to 2.75 L/ha	0.7 to 1.1 L/ac	
plus metribuzin	0.16 to 0.41 kg/ha		
LEXONE DF (75 DF)	0.21 to 0.55 kg/ha	0.08 to 0.22 kg/ac	
or metribuzin	0.35 to 0.5 kg/ha		
SENCOR 75 DF (75 WG)	0.47 to 0.67 kg/ha	0.19 to 0.27 kg/ac	
plus linuron	0.7 to 1 kg/ha		
LOROX DF (50 DF)	1.4 to 2 kg/ha	0.56 to 0.8 kg/ac	
AFOLAN F (480g/L)	1.5 to 2.08 L/ha	0.6 to 0.83 L/ac	
LINURON 480 (480g/L)	1.5 to 2.08 L/ha	0.6 to 0.83 L/ac	
metribuzin	0.41 to 1.13 kg/ha		•Apply preemergent or preplant.
SENCOR 75 DF (75 WG)	0.55 to 1.5 kg/ha	0.22 to 0.6 kg/ac	•Glyphosate (1.25 to 2.5 L/ha(0.5 to 1 L/ac)) is required to control weeds that are taller than 4 cm and to
LEXONE DF (75 DF)	0.53 to 1.33 kg/ha	0.21 to 0.53 kg/ac	control weeds that are inherently tolerant to the other herbicides used in these treatments.
plus imazethapyr	0.075 to 0.1 kg/ha		•For preplant applications the maximum Sencor rate is 1.3 kg/ha.
PURSUIT (240g/L)	0.312 to 0.42 L/ha	0.125 to 0.168 L/ac	
metribuzin	0.42 to 0.55 kg/ha		•Apply preplant
SENCOR 75 DF (75 WG)	0.56 to 0.73 kg/ha	0.22 to 0.29 kg/ac	
LEXONE DF (75 DF)	0.56 to 0.73 kg/ha		
plus linuron	0.85 to 1 kg/ha	0.22 to 0.29 kg/ac	
LOROX DF (50 DF)	1.7 to 2 kg/ha		
		0.68 to 0.8 kg/ac	
metribuzin	0.42 to 0.55 kg/ha		• Apply preplant.
SENCOR 75 DF (75 WG)	0.56 to 0.73 kg/ha	0.22 to 0.29 kg/ac	•Glyphosate (1.25 to 2.5 L/ha(0.5 to 1 L/ac)) is required to control weeds that are taller than 4 cm and to
LEXONE DF (75 DF)	0.56 to 0.73 kg/ha	0.22 to 0.29 kg/ac	control weeds that are inherently tolerant to the other herbicides used in these treatments.
plus metolachlor	1.68 to 2.64 kg/ha		
DUAL (960g/L)	1.75 to 2.75 L/ha	0.7 to 1.1 L/ac	
plus linuron	0.85 to 1 kg/ha		
LOROX DF (50 DF)	1.7 to 2 kg/ha	0.68 to 0.8 kg/ac	
metribuzin	0.56 to 1.12 kg/ha		•Apply preemergent but no later than 3 days prior to crop emergence.
SENCOR 75 DF (75 WG)	0.75 to 1.5 kg/ha	0.3 to 0.6 kg/ac	•See paraquat application instructions in the "Preplant Site Preparation" section.
LEXONE DF (75 DF)	0.75 to 1.5 kg/ha	0.3 to 0.6 kg/ac	
plus paraquat	0.5 kg/ha		
GRAMOXONE (200g/L)	2.5 L/ha	1 L/ac	

metribuzin	0.56 to 1.12 kg/ha		•Apply preplant up to 30 days before planting or preemergent to the crop
SENCOR 75 DF (75 WG)	0.75 to 1.5 kg/ha	0.3 to 0.6 kg/ac	
plus glyphosate TMS	0.41 to 0.825 kg/ha		
TOUCHDOWN 480 (330g/L)	1.25 to 2.5 L/ha	0.5 to 1 L/ac	
metribuzin	0.33 to 0.75 kg/ha		•Apply preemergent
SENCOR 75 DF (75 WG)	0.44 to 1 kg/ha	0.18 to 0.4 kg/ac	
plus linuron	0.5 to 1.2 kg/ha		
AFOLAN F (480g/L)	1.04 to 2.5 L/ha	0.42 to 1 L/ac	
LOROX DF (50 DF)	1 to 2.4 kg/ha	0.4 to 0.96 kg/ac	
LINURON 480 (480g/L)	1.04 to 2.5 L/ha	0.42 to 1 L/ac	
metribuzin	0.3 to 0.5 kg/ha		•Apply preemergent
SENCOR 75 DF (75WG)	0.4 to 0.67 kg/ha	0.16 to 0.27 kg/ac	•Within the applicable rate range, use the higher rate of SENCOR and BROADSTRIKE DUAL under heavy plant residues on soil surface, or heavy weed pressures, or soil of more than 4% organic matter.
plus flumetsulam/metolachlor	1.7 to 2.215 kg/ha		
BROADSTRIKE DUAL (923g/L)	1.85 to 2.4 L/ha	0.74 to 0.96 L/ac	
s-metolachlor	1.05 to 1.6 kg/ha		•Apply preplant
DUAL MAGNUM (915g/L)	1.15 to 1.75 L/ha	0.46 to 0.7 L/ac	
plus glyphosate	0.836 to 0.89 kg/ha		
ROUNDUP (356g/L)	2.35 to 2.5 L/ha	0.94 to 1 L/ac	
s-metolachlor	1.05 to 1.6 kg/ha		•Apply preplant
DUAL MAGNUM (915g/L)	1.15 to 1.75 L/ha	0.46 to 0.7 L/ac	
plus glyphosate	0.836 to 0.89 kg/ha		
ROUNDUP (356g/L)	2.35 to 2.5 L/ha	0.94 to 1 L/ac	
plus metribuzin	0.5 to 1.09 kg/ha		
SENCOR 75 DF (75 WG)	0.67 to 1.45 kg/ha	0.27 to 0.58 kg/ac	
LEXONE DF (75 DF)	0.67 to 1.45 kg/ha	0.27 to 0.58 kg/ac	
s-metolachlor	1.05 to 1.6 kg/ha		•Apply preplant incorporated or preemergent
DUAL MAGNUM (915g/L)	1.15 to 1.75 L/ha	0.46 to 0.7 L/ac	•Maximum Pursuit rate for ppi treatments is 0.312 L/ha
plus imazethapyr	0.075 to 0.1 kg/ha		
PURSUIT (240g/L)	0.312 to 0.42 L/ha	0.125 to 0.168 L/ac	
s-metolachlor	1.05 to 1.6 kg/ha		•Apply preemergent
DUAL MAGNUM (915g/L)	1.15 to 1.75 L/ha	0.46 to 0.7 L/ac	
plus linuron	0.85 to 1.15 kg/ha		
LOROX DF (50 DF)	1.7 to 2.3 kg/ha	0.68 to 0.92 kg/ac	
AFOLAN F (480g/L)	1.77 to 2.39 kg/ha	0.71 to 0.96 L/ac	
LINURON 480 (480g/L)	1.77 to 2.39 L/ha	0.71 to 0.96 L/ac	

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section)
s-metolachlor	1.05 to 1.6 kg/ha		•Apply preemergent
DUAL MAGNUM (915g/L)	1.15 to 1.75 L/ha	0.46 to 0.7 L/ac	
plus metobromuron	1.2 to 1.7 kg/ha		
PATORAN FL (400g/L)	3 to 4.25 L/ha	1.2 to 1.7 L/ac	
s-metolachlor	1.05 to 1.6 kg/ha		•Apply preemergent
DUAL MAGNUM (915g/L)	1.15 to 1.75 L/ha	0.46 to 0.7 L/ac	
plus metribuzin	0.421 to 0.72 kg/ha		
LEXONE DF (75 DF)	0.53 to 0.96 kg/ha	0.21 to 0.38 kg/ac	
or plus metribuzin	0.41 to 1.13 kg/ha		
SENCOR 75 DF (75 WG)	0.55 to 1.5 kg/ha	0.22 to 0.6 kg/ac	
s-metolachlor	1.05 to 1.6 kg/ha		•Apply preplant incorporated
DUAL MAGNUM (915g/L)	1.15 to 1.75 L/ha	0.46 to 0.7 L/ac	
plus metribuzin	0.42 to 0.48 kg/ha		
LEXONE DF (75 DF)	0.56 to 0.64 kg/ha	0.22 to 0.26 kg/ac	
SENCOR 75 DF (75 WG)	0.56 to 0.64 kg/ha	0.22 to 0.26 kg/ac	
s-metolachlor	1.05 to 1.6 kg/ha		•Apply preplant
DUAL MAGNUM (915g/L)	1.15 to 1.75 L/ha	0.46 to 0.7 L/ac	•If emerged annual weeds are taller than 6 cm apply glyphosate prior to the tank mix application or make an application of a 3-way tank mix of s-metolachlor plus glyphosate plus metribuzin,
plus metribuzin*	0.5 to 1.09 kg/ha		•For improved burndown of small emerged annual weeds, the following additives may be applied: Crop oil, 28-0-0, or 10-34-0 at 5% vol/vol; Crop oil concentrate at 1% vol/vol: Non-ionic surfactant at 0.1% vol/vol.
SENCOR 75 DF (75 WG)	0.67 to 1.45 kg/ha	0.27 to 0.58 kg/ac	
LEXONE DF (75 DF)	0.67 to 1.45 kg/ha	0.27 to 0.58 kg/ac	
s-metolachlor	1.05 to 1.6 kg/ha		•Apply preemergent
DUAL MAGNUM (915g/L)	1.15 to 1.75 L/ha	0.46 to 0.7 L/ac	
plus monolinuron	1.1 to 1.7 kg/ha		
AFESIN (200g/L)	5.5 to 8.5 L/ha	2.2 to 3.4 L/ac	
trifluralin	0.6 to 1.155 kg/ha		•Apply preplant incorporated
TREFLAN EC (480g/L)	1.25 to 2.4 L/ha	0.5 to 0.96 L/ac	
RIVAL DF (60 DF)	1 to 1.91 kg/ha	0.4 to 0.76 kg/ac	
BONANZA 400 (400g/L)	1.5 to 2.75 L/ha	0.6 to 1.1 L/ac	
plus metribuzin	0.42 to 0.55 kg/ha		
LEXONE DF (75 DF)	0.56 to 0.73 kg/ha	0.22 to 0.29 kg/ac	
SENCOR 75 DF (75 WG)	0.56 to 0.73 kg/ha	0.22 to 0.29 kg/ac	
clethodim	0.03 to 0.09 kg/ha		•Soybeans are tolerant at any growth stage.
SELECT (240g/L)	0.125 to 0.375 L/ha	0.05 to 0.15 L/ac	•Apply when annual grasses and volunteer cereals are in the 2 to 6 leaf stage.
plus surfactant			•Use the higher rate for quackgrass control. Apply to quackgrass in the 2 to 5 leaf stage.
AMIGO	0.5 to 1 % v/v	0.5 to 1 % v/v	•Add the surfactant AMIGO at 5L/1000L spray solution to this low herbicide rate and 10L/1000L spray solution to the high herbicide rate for quackgrass control.

diclofop-methyl HOE-GRASS 284 (284g/L)	1 kg/ha 3.5 L/ha	1.4 L/ac	•Apply when annual grasses are in the 1 to 4 leaf stage (2 to 3 leaf stage is optimum). •DO NOT mix with other postemergence herbicides because diclofop-methyl is inactivated. • Other postemergence herbicides must be applied at least 4 days before or after diclofop-methyl application. Crabgrass frequently escapes this treatment.
fenoxaprop-p-ethyl EXCEL SUPER (80.5g/L)	0.054 kg/ha 0.67 L/ha	0.27 L/ac	•Apply to emerged annual grasses in the 1 to 6 leaf stage which are actively growing while crop is small enough to permit thorough coverage. •A second application may be necessary to control later emerging grasses.
fluazifop-p-butyl VENTURE 25G (25 DG) plus mineral oil/surfactant TURBOCHARGE	0.075 kg/ha 0.3 kg/ha 0.5 % v/v	 0.12 kg/ac 0.5 % v/v	•Apply at 2-5 leaf stage of volunteer corn.
fluazifop-p-butyl VENTURE 25G (25 DG) plus mineral oil/surfactant TURBOCHARGE	0.125 to 0.25 kg/ha 0.5 to 1 kg/ha 0.5 % v/v	 0.2 to 0.4 kg/ac 0.5 % v/v	•Apply at 2-4 leaf stage of annual grasses and 3-5 leaf stage of quackgrass or wirestem muhly. •Use the 1 kg/ha rate of VENTURE for wirestem muhly.
quizalofop-p-ethyl ASSURE II (96g/L) plus oil concentrate CANPLUS 411 or SURE-MIX	0.036 to 0.072 kg/ha 0.38 to 0.75 L/ha 0.5 to 1 % v/v 0.5 % v/v	 0.15 to 0.3 L/ac 0.5 to 1 % v/v 0.5 % v/v	•Apply to emerged annual grasses and volunteer cereals in 2 leaf to tillering stage and volunteer corn and quackgrass in the 2 to 6 leaf stage. •Use the 0.38 L/ha (0.15 L/ac) rate of ASSURE II for control of volunteer corn, volunteer cereals and green foxtail •The 0.5 L/ha (0.2 L/ac) rate of ASSURE II will suppress quackgrass and also control barnyard grass. •Use the 0.75 L/ha (0.3 L/ac) rate of ASSURE II for control of quackgrass. •Use the higher rate of CANPLUS 411 or SURE-MIX when wild oats and quackgrass are the target weeds or under drought conditions. •DO NOT apply to soybeans within 80 days of harvest.
sethoxydim POAST ULTRA (450g/L) plus oil concentrate ASSIST or plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha 1 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac 0.4 L/ac	• Apply the 0.47 L/ha(0.19 L/ac) rate for wild oats or volunteer cereal control •Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while crop is small enough to permit thorough spray coverage. •Complete control is normally obtained 7 to 21 days after application. A second application may be necessary to control grasses that emerge after the first treatment. Water rates of 100 to 200 L/ha (40-80 L/ac) provide the best results.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 1 to 2 L/ha	 0.45 L/ac 0.4 to 0.8 L/ac	•Thorough preplant tillage will result in more uniform quackgrass emergence. •Apply at 1 to 3 leaf stage of actively growing quackgrass in 110 to 200 L/ha (44-80 L/ac) water. •Crop competition and inter-row cultivation 7 to 14 days after application will assist in quackgrass control for 6 to 8 weeks.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
acifluorfen BLAZER (240g/L)	0.6 kg/ha 2.5 L/ha	 1 L/ac	•Apply to emerged weeds up to 10 cm in height (refer to labels for weed heights) when soybeans are in the 1-3 trifoliate leaf stage. •DO NOT apply before the first trifoliate leaf stage of the soybeans. •Good spray coverage on the weeds is important for good weed control. •Soybeans may exhibit speckling, bronzing and/or leaf burn. The trifoliate leaf emerging at the time of application may be distorted. Soybeans usually outgrow these conditions and continue to grow at a normal rate with no adverse effect on vigour, maturity, or crop yield. •DO NOT apply acifluorfen to soybeans that have been subjected to stress (see product label). •DO NOT add oils or surfactants to applications of acifluorfen at 2.5 L/ha alone.
acifluorfen BLAZER (240g/L) plus oil concentrate ASSIST	0.3 kg/ha 1.25 L/ha 0.5 % v/v	 0.5 L/ac 0.5 % v/v	•Apply to emerged redroot pigweed up to and including the four leaf stage and to common ragweed up to and including the eight leaf stage when soybeans are in the one to three trifoliate leaf stage. •DO NOT apply before the first trifoliate leaf stage of the soybeans. •Good spray coverage on the weeds is important for good weed control •Soybeans may exhibit speckling, bronzing and/or leaf burn. The trifoliate leaf emerging at the time of application may be distorted. Soybeans usually outgrow these conditions and continue to grow at a normal rate with no adverse affects on vigour, maturity or crop yield.
bentazon BASAGRAN FORTE (480g/L)	0.84 to 1.08 kg/ha 1.75 to 2.25 L/ha	 0.7 to 0.9 L/ac	•Apply when soybeans are in unifoliate to 4th trifoliate leaf stage and when weeds are small and actively growing. •Temporary crop injury may occur under abnormally hot, humid conditions. •Cool weather or drought may delay control. •For improved and more consistent control of velvetleaf and lamb's-quarters, 10 L/ha of 28% urea ammonium nitrate (UAN) or 6 L/ha of liquid ammonium sulphate may be added. The addition of either nitrogen source may cause slight leaf burn, but new growth is normal and crop vigour is not reduced. •Use the higher rate of bentazon when weed pressure is high, weeds are large or conditions for activity are unfavourable.
chlorimuron-ethyl CLASSIC (25 DF) plus non-ionic surfactant	9 g/ha 36 g/ha 2 L/1000L	 14 g/ac 2 L/1000L	•DO NOT use on soils with pH >= 7.5. •Optimal timing for broadleaf control is when the soybeans are in the 1 to 3 trifoliate stage of growth. • DO NOT apply before the first trifoliate is fully expanded or after the initiation of flowering. •Add a non-ionic surfactant at 0.2 % v/v. •Addition of 28% UAN is recommended for improved control of velvetleaf.
chlorimuron-ethyl/ thifensulfuron-methyl RELIANCE STS ((1.75:1) 33DF) plus non-ionic surfactant	9.2 to 14.1 g/ha 27.6 to 42.8 g/ha 2 L/1000 L	 11.2 to 17.3 g/ac 2 L/1000 L	•USE ONLY ON STS VARIETIES OF SOYBEAN •At the 17.3 g/ac rate each water soluble pack treats 1 ac. •DO NOT break open individual packages •DO NOT use on soils with pH >=7.5. •Use the high rate for control of ragweed, lamb's-quarters, and/or velvetleaf. •Optimal timing for weed control usually coincides with the 1-3 trifoliate stage of the soybeans. •Addition of 28% UAN is recommended for improved velvetleaf control.

fomesafen REFLEX (240g/L) plus non-ionic surfactant AGRAL 90 or plus mineral oil/surfactant TURBOCHARGE	0.24 kg/ha 1 L/ha 0.25% v/v 0.5 % v/v	 0.4 L/ac 0.25 % v/v 0.5 % v/v	•Apply early postemergence at 1-2 trifoliate to crop when weeds are small and actively growing (2-4 leaf stage). • Use 200-350 L/ha (80-140 L/ac) water. Use higher rates of water and pressure for a heavy weed or crop canopy. •Some bronzing may occur to soybean leaves at the time of application, but plants outgrow these effects without harming maturity or yield. •DO NOT apply Reflex to any field more often than once every two years. •DO NOT apply to soybeans under stress. • Some rotational cropping restrictions apply (See Notes on Chemicals).
thifensulfuron- methyl PINNACLE (75 DF) plus surfactant AGRAL 90, CITOWETT, AGSURF, or SUPER SPREADER STICKER	4.1 to 6 g/ha 5.5 to 8 g/ha 0.1 % v/v	 2.2 to 3.2 g/ac 0.1 % v/v	•Apply to emerged weeds up to 10 cm in height when soybeans have the first trifoliate leaf fully expanded. •DO NOT apply to soybeans which have initiated flowering. •The higher rate should be used for lamb's-quarters and velvetleaf. •The addition of UAN (28-0-0) at 4% v/v will enhance the control of velvetleaf.
glyphosate ROUNDUP TRANSORB (360g/L)	0.9 kg/ha 2.5 L/ha	 1 L/ac	•FOR USE ONLY WITH PEDIGREED (CERTIFIED) SOYBEAN SEED DESIGNATED AS "ROUNDUP READY SOYBEANS". •Apply between the first trifoliate leaf stage and the bud or early flower stage of the soybeans. •Weeds are more easily controlled and weed competition avoided when applications are made when weeds are small, although weeds up to 25 cm tall will be controlled. •A second application may be made for later flushes emerging after the initial application. •Use 100 - 200 L/ha (40-80 L/ac) water.
glyphosate ROUNDUP TRANSORB (360g/L)	1.8 kg/ha or 0.9 + 0.9 kg/ha 5 L/ha or 2.5 + 2.5 L/ha	 2 L/ac or 1 + 1 L/ac	•FOR USE ONLY WITH PEDIGREED (CERTIFIED) SOYBEAN SEED DESIGNATED AS "ROUNDUP READY SOYBEANS". •Apply when milkweed is 15 to 60 cm and nutsedge is 5 to 15 cm in height and actively growing for best results. •If the sequential applications are used they should be at least 2 weeks apart for best results.
imazamox + fomesafen VIPER (70WG) + REFLEX (240g/L) plus non-ionic surfactant AGRAL 90 plus liquid fertilizer 28-0-0, 32-0-0	25 g/ha + 0.2 kg/ha 36 g/ha + 0.83 L/ha 0.25% v/v 2 L/ha	 14.5 g/ac + 0.336 L/ac 0.25% v/v 0.8 L/ac	•VIPER is only available in a package containing both imazamox and fomesafen. •Apply postemergence to the crop after the unifoliate stage. •Weeds should be in the 1 to 6 leaf stage and actively growing. •A non-ionic surfactant applied at 0.25% v/v and liquid fertilizer (28-0-0, 32-0-0) at 2 L/ha must be added to the spray solution. •Some rotational cropping restrictions apply (see label).

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
imazethapyr	0.075 to 0.1 kg/ha		•Apply when the weeds are up to the 2 true leaf stage.
PURSUIT (240g/L)	0.312 to 0.42 L/ha	0.125 to 0.168 L/ac	•Some rotational cropping restrictions apply (see "Notes on Chemicals").
plus non-ionic surfactant	0.25 % v/v	0.25 % v/v	•Use only once per season.
plus liquid fertilizer			
28-0-0, 10-34-0, or 32-0-0	2 L/ha	0.8 L/ac	
acifluorfen	0.15 kg/ha		•Use when lamb's-quarter is the dominant weed
BLAZER (240g/L)	0.63 L/ha	0.25 L/ac	
plus bentazon	0.84 kg/ha		
BASAGRAN FORTE (480g/L)	1.75 L/ha	0.7 L/ac	
acifluorfen	0.3 kg/ha		•Use when common ragweed and/or redroot pigweed are the dominant weed(s)
BLAZER (240g/L)	1.25 L/ha	0.5 L/ac	
plus bentazon	0.6 kg/ha		
BASAGRAN FORTE (480g/L)	1.25 L/ha	0.5 L/ac	
fenoxaprop-p-ethyl	0.054 kg/ha		•If annual broadleaf and grassy weeds are not in the correct stage for a tank mix application, use a split application at the correct stage for each product
EXCEL SUPER (80.5g/L)	0.67 L/ha	0.27 L/ac	
plus bentazon	0.84 to 1.08 kg/ha		
BASAGRAN FORTE (480g/L)	1.75 to 2.25 L/ha	0.7 to 0.9 L/ac	
fenoxaprop-p-ethyl	0.054 kg/ha		•If broadleaf and grassy weeds are not in the correct stage for a tank mix application, use a split application at the correct stage for each product.
EXCEL SUPER (80.5g/L)	0.67 L/ha	0.27 L/ac	
plus bentazon	0.84 to 1.08 kg/ha		
BASAGRAN FORTE (480g/L)	1.75 to 2.25 L/ha	0.7 to 0.9 L/ac	
plus thifensulfuron-methyl	4.1 to 6 g/ha		
PINNACLE (75 DF)	5.5 to 8 g/ha	2.2 to 3.2 g/ac	
fenoxaprop-p-ethyl	0.054 kg/ha		•If broadleaf and grassy weeds are not in the correct stage for a tank mix application, use a split application at the correct stage for each product.
EXCEL SUPER (80.5g/L)	0.67 L/ha	0.27 L/ac	
plus thifensulfuron-methyl	4.1 to 6 g/ha		
PINNACLE (75 DF)	5.5 to 8 g/ha	2.2 to 3.2 g/ac	
fluazifop-p-butyl	0.125 to 0.25 kg/ha		•Apply at the 2-4 leaf stage of annual grasses and broadleaf weeds.
VENTURE 25G (25 DG)	0.5 to 1 kg/ha	0.2 to 0.4 kg/ac	•DO NOT tank mix if weed leaf stages are not at the correct timing.
plus bentazon	0.84 to 1.08 kg/ha		
BASAGRAN FORTE (480g/L)	1.75 to 2.25 L/ha	0.7 to 0.9 L/ac	
plus mineral oil/surfactant			
TURBOCHARGE	0.5 % v/v	0.5 % v/v	

fluazifop-p-butyl	0.125 to 0.25 kg/ha		•Apply at the 2-4 leaf stage of annual grasses and broadleaf weeds.
VENTURE 25G (25 DG)	0.5 to 1 kg/ha	0.2 to 0.4 kg/ac	•DO NOT tank mix if weed leaf stages are not at the correct timing.
plus bentazon	0.84 to 1.08 kg/ha		
BASAGRAN FORTE (480g/L)	1.75 to 2.25 L/ha	0.7 to 0.9 L/ac	
plus thifensulfuron-methyl	4.1 to 6 g/ha		
PINNACLE (75 DF)	5.5 to 8 g/ha	2.2 to 3.2 g/ac	
plus mineral oil/surfactant			
TURBOCHARGE	0.5 % v/v	0.5 % v/v	
fluazifop-p-butyl	0.125 to 0.25 kg/ha		•Apply at 2-4 leaf stage of annual grasses and 2 leaf stage of broadleaf weeds.
VENTURE 25G (25 DG)	0.5 to 1 kg/ha	0.2 to 0.4 kg/ac	
plus imazethapyr	0.075 to 0.1 kg/ha		
PURSUIT (240g/L)	0.312 to 0.42 L/ha	0.125 to 0.168 L/ac	
plus mineral oil/surfactant			
TURBOCHARGE	0.5 % v/v	0.5 % v/v	
fomesafen	0.24 kg/ha		•Apply early postemergence at 2-4 leaf stage of annual weeds and 1-2 trifoliate to the crop.
REFLEX (240g/L)	1 L/ha	0.4 L/ac	•Add VENTURE to the tank first and agitate, followed by REFLEX and TURBOCHARGE last.
plus fluazifop-p-butyl	0.125 to 0.25 kg/ha		•DO NOT tank mix if weed leaf stages are not at the correct timing.
VENTURE 25G (25 DG)	0.5 to 1 kg/ha	0.2 to 0.4 kg/ac	
plus mineral oil/surfactant			
TURBOCHARGE	0.5 % v/v	0.5 % v/v	
fomesafen	0.19 to 0.24 kg/ha		•Use the lower rate of REFLEX for ragweed only.
REFLEX (240g/L)	0.8 to 1 L/ha	0.32 to 0.4 L/ac	•Use the higher rate of REFLEX for lamb's-quarters.
plus imazethapyr	0.075 kg/ha		•Add liquid fertilizer at 2 L/ha.
PURSUIT (240g/L)	0.312 L/ha	0.125 L/ac	
plus non-ionic surfactant			
AGRAL 90	0.25 % v/v	0.25 % v/v	
plus liquid fertilizer	2 L/ha	0.8 L/ac	
fomesafen	0.24 kg/ha		•Apply early postemergence at the 2-4 leaf stage of weeds and 1-2 trifoliate to the crop.
REFLEX (240g/L)	1 L/ha	0.4 L/ac	
plus thifensulfuron-methyl	6 g/ha		
PINNACLE (75DF)	8 g/ha	3.2 g/ac	
plus non-ionic surfactant			
AGRAL 90	0.25 % v/v	0.25 % v/v	
imazethapyr	0.075 kg/ha		•
PURSUIT (240g/L)	0.312 L/ha	0.125 L/ac	
plus bentazon	0.6 to 0.84 kg/ha		
BASAGRAN FORTE (480g/L)	1.25 to 1.75 L/ha	0.5 to 0.7 L/ac	
plus liquid fertilizer			
28-0-0, 10-34-0, or 32-0-0	2 L/ha	0.8 L/ac	

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
quizalofop-p-ethyl	0.06 kg/ha		•Apply to soybeans within the 1-4 trifoliate stage, ensuring the 1st trifoliate is fully expanded before application. •DO NOT apply to soybeans which have initiated flowering. •If leaf stages of the grass and broadleaf weeds do not coincide, a sequential application of the grass and broadleaf herbicides is required to ensure satisfactory control. •Use the higher rate of CANPLUS 411 or SURE-MIX under conditions not conducive to good growth.
ASSURE II (96g/L)	0.63 L/ha	0.25 L/ac	
plus thifensulfuron-methyl	4.1 to 6 g/ha		
PINNACLE (75 DF)	5.5 to 8 g/ha	2.2 to 3.2 g/ac	
plus bentazon	0.84 to 1.08 kg/ha		
BASAGRAN FORTE (480g/L)	1.75 to 2.25 L/ha	0.7 to 0.9 L/ac	
plus oil concentrate			
CANPLUS 411	0.5 to 1 % v/v	0.5 to 1 % v/v	
or SURE-MIX	0.5 % v/v	0.5 % v/v	
quizalofop-p-ethyl	0.048 kg/ha		•Delay application until soybeans have 1-2 fully expanded trifoliate leaves. •DO NOT apply to soybeans which have initiated flowering. •If leaf stages of the grass and broadleaf weeds do not coincide, a sequential application of the grass and broadleaf herbicides is required to ensure satisfactory control. •Use the higher rate of CANPLUS 411 or SURE-MIX under conditions not conducive to good growth. •Velvetleaf control may be reduced with a tankmix application. •For optimum control, make separate applications of thifensulfuron methyl and quizalofop ethyl herbicides.
ASSURE II (96g/L)	0.5 L/ha	0.2 L/ac	
plus thifensulfuron-methyl	4.1 to 6 g/ha		
PINNACLE (75 DF)	5.5 to 8 g/ha	2.2 to 3.2 g/ac	
plus oil concentrate			
CANPLUS	0.5 to 1 %v/v	0.5 to 1 % v/v	
or			
SURE-MIX	0.5 % v/v	0.5 % v/v	
thifensulfuron- methyl	4.1 to 6 g/ha		•Apply to emerged weeds when soybeans have the first trifoliate leaf fully expanded. •DO NOT apply to soybeans which have initiated flowering. • If Canada thistle, yellow nutsedge and field bindweed are target species a second application may be required. •UAN (28-0-0) should not be added to this tankmix.
PINNACLE (75 DF)	5.5 to 8 g/ha	2.2 to 3.2 g/ac	
plus bentazon	0.84 to 1.08 kg/ha		
BASAGRAN FORTE (480g/L)	1.75 to 2.25 L/ha	0.7 to 0.9 L/ac	
glyphosate	1.71 to 2.52 kg/ha		•Apply as a spot treatment when quackgrass has more than 3 to 4 leaves per stem, thistles are at bud to flower stage. •The crop will be killed in the sprayed area. •Applications may be made up to pod set but not after seed set.
ROUNDUP TRANSORB (360g/L)	4.75 to 7 L/ha	1.9 to 2.8 L/ac	
GLYFOS (360g/L)	4.75 to 7 L/ha	1.9 to 2.8 L/ac	
or glyphosate TMS	1.567 to 2.31 kg/ha		
TOUCHDOWN 480 (330g/L)	4.75 to 7 L/ha	1.9 to 2.8 L/ac	
glyphosate	2.52 to 4.32 kg/ha		•Apply as a spot treatment when milkweed, dogbane and bindweed are at bud to flower stage. •The crop will be killed in the sprayed area.
ROUNDUP TRANSORB (360g/L)	7 to 12 L/ha	2.8 to 4.8 L/ac	
GLYFOS (360g/L)	7 to 12 L/ha	2.8 to 4.8 L/ac	
or glyphosate TMS	2.31 to 3.96 kg/ha		
TOUCHDOWN 480 (330g/L)	7 to 12 L/ha	2.8 to 4.8 L/ac	

glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360 g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.36 kg/2L water 1 L/2L water 1 L/2L water 0.33 kg/2L water 1 L/2L water		•Apply to weeds which extend above the crop sufficiently to allow good contact with the application equipment. •Be careful not to contact the crop with the equipment or allow the chemical solution to drip from the applicator on to the crop. •A 33% solution of the herbicide mixture (1 L of ROUNDUP TRANSORB, GLYFOS or TOUCHDOWN 480 to 2 L of water) provides good control of most weeds.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360 g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.9 kg/ha 2.5 L/ha 2.5 L/ha 2.5 L/ha	 1 L/ac 1 L/ac 1 L/ac	•Apply in 50 to 100 L/ha (20-40 L/ac) water when the crop is 30% grain moisture or less. •DO NOT apply to crops grown for seed. •Apply at least 7 days prior to harvest when pod tissue is dry and brown and 80-90% of original leaves have dropped.
diquat REGLONE (200g/L) plus surfactant AGRAL 90	0.42 to 0.55 kg/ha 2.1 to 2.75 L/ha 1 L/1000L	 0.84 to 0.9 L/ac 1 L/1000L	•Apply in 300 L/ha (120 L/ac) water to burn off weeds when 80 to 90% natural crop leaf defoliation has occurred. •Beware of drift to adjacent crops or plants.

Stages Of Soybean Leaf Development

Notes:

Weed control ratings are given as 0-9 where 0 indicates no control and 9 indicates 90%-100% control under ideal conditions.

Ratings are subjective values based on best available information and give general comparisons based on use as descibed in this guide.

Crop tolerance ratings are E - Excellent, G - Good, F - Fair, P - Poor.

Under unfavorable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used.

Ratings in **BOLD** suggest the weed is listed on the product label for control or suppression.

Please see product label for more information on registered weed species, product uses and precautions.

Table 13. Soybean Herbicide Weed Control Ratings

		Grasses						Annual Broadleaves									Perennials							
Treatment	**Trade Name**	barnyard grass(a)	crabgrass	fall panicum	foxtails(a)	old witch grass(a)	proso millet	buckwheat, wild	cocklebur	lady's thumb	lamb's-quarters(a)	mustards(a)	nightshades, annual	pigweeds(a,b)	ragweed(a)	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	**Crop Tolerance**
soil applied grass herbicides																								
dimethenamid	FRONTIER	**9**	**9**	**8**	**9**	**9**	6	2	2	2	7	2	**8**	**8**	2	2	0	0	0	**8**	0	0	0	G
s-metolachlor	DUAL MAGNUM	**9**	**9**	**8**	**9**	**9**	6	2	2	2	7	2	**8**	**8**	2	2	0	0	0	**8**	0	0	0	G
ethalfluralin	EDGE	**9**	**9**	**8**	**9**	**9**	7	**8**	2	**6**	**8**	2	**6**	**8**	2	2	4	2	2	2	2	2	2	G
trifluralin	TREFLAN, BONANZA, RIVAL	**9**	**9**	8	**9**	9	6	**5**	2	2	**8**	2	2	**8**	2	2	2	2	2	2	2	2	2	G
soil applied broadleaf herbicides																								
linuron	AFOLAN, LOROX	**5**	**5**	5	**5**	**5**	5	**8**	5	**9**	**9**	9	7	**9**	**8**	**6**	2	2	2	2	2	2	2	G
metobromuron	PATORAN	**5**	**5**	**5**	**5**	**5**	5	8	5	**9**	**9**	**9**	**7**	**9**	**8**	6	2	2	2	2	2	2	2	G
metribuzin	LEXONE, SENCOR	**7**	**6**	**7**	**8**	**8**	3	7	7	**9**	**9**	**9**	3	**9**	**8**	**8**	2	2	2	2	2	2	2	G
monolinuron	AFESIN	**5**	**5**	5	**5**	5	5	**8**	5	**9**	**9**	9	**7**	**9**	**8**	6	2	2	2	2	2	2	2	G
soil applied grass and broadleaf herbicides																								
flumetsulam/ metolachlor	BROADSTRIKE DUAL	**9**	**9**	**8**	**9**	**9**	6	7	**7**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	2	2	?	**8**	0	3	4	E
flumetsulam/ trifluralin	BROADSTRIKE TREFLAN	**9**	**9**	**8**	**9**	9	6	8	**7**	9	**9**	9	**9**	**9**	**8**	**9**	2	2	?	5	2	3	5	E
imazethapyr	PURSUIT	**8**	7	7	**9**	**8**	**7**	8	7	**9**	**9**	**9**	**9**	**9**	**8**	**9**	2	2	2	**7**	6	2	2	E
imazethapyr + metribuzin	CONQUEST [3]	**8**	7	7	**9**	8	7	8	8	**9**	**9**	9	**9**	**9**	**9**	**9**	2	2	2	**7**	6	2	2	G
imazethapyr/pendimethalin	VALOR	**9**	9	9	**9**	9	8	8	7	9	**9**	9	9	**9**	**8**	**9**	2	2	2	7	6	2	2	E
postemergent grass herbicides																								

Table 13. Soybean Herbicide Weed Control Ratings

Treatment	Trade Name	Grasses						Annual Broadleaves									Perennials							Crop Tolerance
		barnyard grass(a)	crabgrass	fall panicum	foxtails(a)	old witch grass(a)	proso millet	buckwheat, wild	cocklebur	lady's thumb	lamb's-quarters(a)	mustards(a)	nightshades, annual	pigweeds(a,b)	ragweed(a)	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	
clethodim	SELECT	**9**	**8**	**9**	**9**	**9**	**9**	0	0	0	0	0	0	0	0	0	0	0	0	0	**7**	0	0	E
diclofop-methyl	HOE-GRASS	**8**	**5**	**8**	**8**	**8**	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	E
fenoxaprop-p-ethyl	EXCEL SUPER	**9**	**8**	**9**	**9**	**9**	**9**	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	E
fluazifop-p-butyl	VENTURE 25G	**9**	8	9	**8**	9	**8**	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	0	0	E
quizalofop-p-ethyl	ASSURE II	**9**	8	9	**9**	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	0	0	E
sethoxydim	POAST ULTRA	**9**	**8**	**9**	**9**	**9**	**9**	0	0	0	0	0	0	0	0	0	0	0	0	0	**6**	0	0	E
postemergent broadleaf herbicides																								
acifluorfen	BLAZER	0	0	0	0	0	0	7	**6**	**8**	**7**	**9**	**8**	**9**	**9**	7	**7**	6	**5**	2	2	6	**6**	F
bentazon	BASAGRAN, BASAGRAN FORTE	0	0	0	0	0	0	7	**9**	**9**	**8**	**9**	7	**7**	**8**	**9**	**5**	2	2	**8**	1	**5**	**7**	G
chlorimuron ethyl	CLASSIC	0	0	0	0	0	0	4	9	8	3	9	3	**9**	**8**	**8**	2	2	8	8	2	8	4	G
chlorimuron-ethyl /thifensulfuron-methyl	RELIANCE [1]	0	0	0	0	0	0	7	9	**9**	**9**	**9**	3	**9**	**9**	**9**	2	2	8	8	2	8	2	E[1]
fomesafen	REFLEX	0	0	0	0	0	0	8	**7**	**8**	**6**	**9**	**8**	**9**	**9**	**6**	?	?	?	?	?	?	?	G
thifensulfuron-methyl	PINNACLE	0	0	0	0	0	0	?	5	**8**	**9**	**8**	3	**9**	5	**8**	2	2	2	2	2	2	2	G
postemergent grass and broadleaf herbicides																								
glyphosate	ROUNDUP [2]	**9**	**9**	9	**9**	9	9	**7**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**9**	7/8	5	8	8	**9**	8	9	E[2]
imazethapyr	PURSUIT	**9**	**8**	6	**9**	**9**	**8**	**8**	**8**	9	**8**	**9**	**9**	**9**	8	**9**	2	2	2	5	2	2	2	G
imazamox+fomesafen	VIPER [3]	**8**	6	**8**	**8**	**9**	?	9	7	**9**	**8**	**9**	**9**	**9**	**9**	**8**	?	5	?	?	5	8	?	G

(a) Group 5 (triazine) resistant biotypes exist

(b) Group 2 resistant biotypes exist

? Insufficient information available to make a rating

[1] Use only on soybean varieties designated as "STS"

[2] Use only on certified soybean seed designated as "Roundup Ready" Soybean.

[3] indicates herbicides sold as a co-pack under this trade name

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)

Sunflowers

Cultural control of weeds in sunflowers can be used successfully, but only if weeds are also controlled in other crops in the rotation. There are several tillage options in the sunflower crop.

Preplant tillage can control one or two flushes of early germinating weeds. Plant sunflowers immediately after the last tillage operation.

A rotary hoe set to cultivate shallow can be effective in removing annual weeds which are just emerging. It is not very useful for controlling well rooted seedlings.

Spring tooth harrows can be used to control small weeds when sunflowers are in the 4 to 6 leaf stage. There will be some damage to sunflowers and larger weeds will not be well controlled.

One or two cultivations with a row crop cultivator is the most common form of cultural control. Sunflowers have to be big enough to withstand burial. Lateral roots on sunflowers are shallow, so avoid cultivating too deep or too close to plants.

PREPLANT - See under **PREPLANT - SITE PREPARATION** for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

EPTC EPTAM (800g/L)	3.4 kg/ha 4.25 L/ha	 1.7 L/ac	•Apply preplant and incorporate immediately to prevent loss. •DO NOT use on light sandy soils with less than 3% organic matter.
trifluralin TREFLAN EC (480g/L) RIVAL DF (60 DF)	0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1 to 1.91 kg/ha	 0.5 to 0.96 L/ac 0.4 to 0.76 kg/ac	•Apply preplant and incorporate as soon as possible and within 24 hours.
clethodim SELECT (240g/L) plus surfactant AMIGO	0.03 to 0.09 kg/ha 0.13 to 0.38 L/ha 0.5 to 1 % v/v	 0.05 to 0.15 L/ac 0.5 to 1 % v/v	•Apply when the annual grasses and volunteer cereals are in the 2 to 6 leaf stage. •Apply to quackgrass in the 2 to 5 leaf stage. Use the higher rate for control of quackgrass. •ALLOW 72 DAYS BETWEEN APPLICATION AND HARVEST.
fluazifop-p-butyl VENTURE 25G (25 DG) plus mineral oil/surfactant TURBOCHARGE	0.075 kg/ha 0.3 kg/ha 0.5 % v/v	 0.12 kg/ac 0.5 % v/v	•This rate is for control of volunteer corn only •Apply at 2-5 leaf stage of the volunteer corn.
fluazifop-p-butyl VENTURE 25G (25 DG) plus mineral oil/surfactant TURBOCHARGE	0.125 to 0.18 kg/ha 0.5 to 0.7 kg/ha 0.5 % v/v	 0.2 to 0.28 kg/ac 0.5 % v/v	•Apply at 2-4 leaf stage of annual grasses and at 3-5 leaf stage quackgrass.

diquat REGLONE (200g/L) plus surfactant AGRAL 90	0.3 kg/ha 1.5 L/ha 0.1 % v/v	 0.6 L/ac 0.1 % v/v	•Diquat may be used to reduce the period of time from maturity to harvest, to speed up harvesting, and decrease seed moisture at harvest. •Apply in 45 L/ha (18 L/ac) water with fixed wing aircraft. •Spray when seeds reach maturity (20% to 50% seed moisture). •Combine 15 to 20 days after spraying. •Beware of drift to adjacent crops or plants. •See "Notes on Chemicals" for comments on aerial application.

Weed control ratings are given as 0-9 where 0 indicates no control and 9 indicates 90%-100% control under ideal conditions.

Ratings are subjective values based on best available information and give general comparisons based on use as descibed in this guide.

Under unfavorable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used.

Ratings in **BOLD** suggest the weed is listed on the product label for control or suppression.

Please see product label for more information on registered weed species, product uses and precautions.

Table 14. Sunflower Herbicide Weed Control Ratings

		Grasses							Annual Broadleaves									Perennials						
Treatment	Trade Name	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	wild oats	buckwheat, wild	cocklebur	lady's-thumb	lamb's-quarter	mustards	nightshades	pigweeds	ragweed	velvetleaf	field bindweed	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
soil applied grass herbicides																								
EPTC	EPTAM	**9**	**9**	**9**	**9**	**9**	7	**8**	2	2	7	**7**	5	8	**7**	5	5	?	?	?	**8**	**7**	?	?
trifluralin	TREFLAN, RIVAL	**9**	**9**	9	**9**	9	7	**7**	**5**	2	2	**8**	2	2	**8**	2	2	2	2	2	2	2	2	2
postemergent grass herbicides																								
clethodim	SELECT	**9**	**8**	**9**	**9**	**9**	**9**	**8**	0	0	0	0	0	0	0	0	0	0	0	0	0	**7**	0	0
fluazifop-p-butyl	VENTURE 25DG	**9**	8	9	**8**	9	**8**	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	0	0

? Insufficient information available to make a rating.

Tobacco

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

Apply in 150 to 300 L/ha (60-120 L/ac) water

fluazifop-p-butyl FUSILADE II (125g/L)	0.075 to 0.125 kg/ha 0.6 to 1 L/ha	 0.24 to 0.4 L/ac	May be applied up to 45 days to harvest.
napropamide DEVRINOL DF (50 DF)	1.125 to 2.25 kg/ha 2.25 to 4.5 kg/ha	 0.9 to 1.8 kg/ac	Apply immediately following transplanting in a 25 to 30 cm band over the transplants. Use lower rates on lighter soils. For best results, lightly incorporate or apply irrigation if rainfall does not occur within 2 days of application. After harvest, soil should be worked at right angles to the rows to prevent injury to succeeding crops. Small grains may be seeded in the fall to prevent soil erosion. These grains may be stunted but not otherwise affected.

Wheat (Spring), Oats and Barley Not Underseeded to Forage Crops

Apply all treatments in 100 to 200 L/ha (40-80 L/ac) water except where otherwise noted.

Crop rotation is a valuable technique used to prevent the build up of weed populations associated with small grain production. Wild oats can increase in population and severely limit production on fields where small grains are grown continuously. Some weeds (e.g., proso millet) will be well controlled by cereal competition.

Blind harrowing with a light harrow, before emergence of cereals, can help to control small germinating weeds. A light harrow can also be used in cereals up to the 3 leaf stage, or a weeder harrow (L shaped flexible tines) at the 4 leaf stage to provide better control of small annual broadleaf weeds. The timing of these harrowing operations is critical. The weeds must be small and the soil surface must be dry and easily worked.

Weeds must be emerged from the soil surface and in early stages of growth to be killed by the rates of the herbicides used on cereal grains. Weeds which are growing during early periods of cereal growth (up to 5 leaf stage) have the greatest effect on the cereal yield.

Cereals are usually quite resistant to injury from 2,4-D, MCPA, 2,4-DB and MCPB. The growth stage for maximum safety varies with the cereal and the herbicide. Check the label for appropriate timing. When counting the leaves on cereal plants, some confusion can occur if tiller leaves are present. These leaves are not counted. The above diagram may be useful when determining the cereal leaf stages referred to in the publication.

Cereal grains have an advantage in that they do not make use of the full growing season. This is particularly true of the winter cereals where preplant cultivation and postharvest cultivation can be used to stimulate germination of weed seeds and reduce perennial weed populations.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

triallate AVADEX BW (400g/L)	1.4 to 1.7 kg/ha 3.5 to 4.25 L/ha	 1.4 to 1.7 L/ac	Wild oats in spring barley and spring wheat. Do not use on tame oats. For wheat, triallate must be applied after planting and worked into the soil to kill wild oats. For barley, triallate can be applied before or after planting and must be worked into the soil. Consult the label for specific instructions on how to work the herbicide into the soil. Use the higher rate on heavier soils.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
diclofop-methyl HOE-GRASS 284 (284g/L)	0.71 to 0.795 kg/ha 2.5 to 2.8 L/ha	 1 to 1.12 L/ac	Apply when the annual grasses are in the 1 to 5 leaf stage. The higher rate (2.8 L/ha (1.12 L/ac)) must be used to control wild oats in the 4 to 5 leaf stage. Hoe-Grass must only be applied in the 1 to 4 leaf stage of barley and prior to tillering (usually not later than 21 days after emergence of the crop). Application beyond the 4 leaf stage or after tillering may result in barley damage. Bromoxynil (PARDNER) may be tank mixed with HOE-GRASS for control of broadleaf weeds. Consult the label for complete mixing instructions. If other herbicides are used for broadleaf weed control, they should be applied at least 4 days before or after HOE-GRASS.
difenzoquat AVENGE 200C (200g/L)	0.7 to 0.85 kg/ha 3.5 to 4.25 L/ha	 1.4 to 1.7 L/ac	Do not use on tame oats. Use the lower rate of difenzoquat if the wild oat stand is less than 200 plants per m2. Apply when the wild oats are in the 3 to 5 leaf stage. DO NOT use when the plants are wet or if rain is expected within 6 hours.
tralkoxydim ACHIEVE 80DG (80 DG) plus TURBOCHARGE	0.2 kg/ha 0.25 kg/ha 0.5 L/100L	 0.1 kg/ac 0.5 L/100L	Do not use on tame oats. Apply at 1 to 6 leaf stage of wild oats. Apply in 110 L/ha (44 L/ac) water. Herbicides not listed on the label may be applied separately 7 days after application of ACHIEVE 80DG. Wild oat control will be reduced if REFINE EXTRA is applied before ACHIEVE 80DG. DO NOT tankmix REFINE EXTRA with ACHIEVE 80DG. Mature straw may be fed to livestock. One application per year.
2,4-D * 2,4-D (470g/L)	0.35 to 0.85 kg/ha 0.75 to 1.8 L/ha	 0.3 to 0.7 L/ac	Apply when the crop is in the 3 to 5 leaf stage of growth. On oats, do not apply more than 0.5 kg/ha (active) or 1.06 L/ha (0.42 L/ac) (470 g/L) product.
2,4-D/ dicamba/ mecoprop KIL-MOR (485g/L)	0.413 to 0.534 kg/ha 0.85 to 1.1 L/ha	 0.34 to 0.44 L/ac	For barley, use only the lower rate and apply when the crop is in the 2 to 3 leaf stage. For wheat apply when the crop is in the 3 to 4 leaf stage. The higher rate is required for control of Canada thistle and field bindweed.
2,4-DB CALIBER 400 (400g/L) COBUTOX 600 (600g/L) EMBUTOX 625 (625g/L)	1.1 to 1.4 kg/ha 2.75 to 3.5 L/ha 1.8 to 2.3 L/ha 1.75 to 2.25 L/ha	 1.1 to 1.4 L/ac 0.72 to 0.92 L/ac 0.7 to 0.9 L/ac	Apply 2,4-DB at the 5 leaf to early flag stage of cereals.
bromoxynil PARDNER (280g/L)	0.28 to 0.336 kg/ha 1 to 1.2 L/ha	 0.4 to 0.48 L/ac	Apply when the weeds are in the 1 to 4 leaf stage and cereals are in the 2 to early flag leaf stage. Best results are in the 2 to 5 leaf cereal stage since thorough coverage of weed foliage is required for optimum weed control.
bromoxynil PARDNER (280g/L) plus 2,4-D 2,4-D (470g/L) or plus MCPA MCPA AMINE (500g/L)	0.28 kg/ha 1 L/ha 0.28 kg/ha 0.6 L/ha 0.28 to 0.55 kg/ha 0.55 to 1.1 L/ha	 0.4 L/ac 0.24 L/ac 0.22 to 0.44 L/ac	Include 2,4-D or the lower rate of MCPA in mustards are present. Use the higher rate of MCPA if hempnettle is present. DO NOT use the 2,4-D mixture on oats and only on barley at the 4 to 5 leaf stage.
bromoxynil/ MCPA BUCTRIL M ((1:1)560g/L)	0.56 kg/ha 1 L/ha	 0.4 L/ac	Apply when weeds are in the 1 to 4 leaf stage and cereals are in the 2 to early flag leaf stage. Wild buckwheat, common ragweed, mustards and lamb's-quarters are controlled up to the 8 leaf stage. Best results are obtained with applications at the 2 to 5 leaf cereal stage since thorough spray coverage of weed foliage is required for optimum weed control.

bromoxynil/ MCPA BUCTRIL M ((1:1)560g/L) plus thifensulfuron-methyl tribenuron-methyl REFINE EXTRA (75 DF) plus surfactant AGRAL 90, AGSURF, or CITOWETT PLUS	0.56 kg/ha 1 L/ha 5 g/ha 6.7 g/ha 2 L/1000L	0.4 L/ac 2.7 g/ac 2 L/1000L	Do not use on oats. Improved control of chickweed and hempnettle up to the 6 leaf stage with the addition of REFINE EXTRA.
clopyralid LONTREL 360 (360g/L)	0.15 to 0.2 kg/ha 0.42 to 0.56 L/ha	0.17 to 0.22 L/ac	For the control of Canada thistle and perennial sow-thistle (top growth only). Should be applied when wheat or barley are at the three leaf to flag leaf emergence stages.
clopyralid LONTREL 360 (360g/L) plus 2,4-D 2,4-D (470g/L) or plus MCPA MCPA AMINE (500g/L)	0.1 to 0.25 kg/ha 0.28 to 0.69 L/ha 0.35 to 0.85 kg/ha 0.75 to 1.81 L/ha 0.35 to 0.85 kg/ha 0.7 to 1.7 L/ha	0.11 to 0.28 L/ac 0.3 to 0.72 L/ac 0.28 to 0.68 L/ac	Read and follow the label of each tank mix product used for precautionary statements directions for use, weeds controlled and any other restrictions. Adhere to the most restrictive label limitations and precautions. In combination with 2,4-D or MCPA, the lower rate of clopyralid (LONTREL 360) will provide control of Canada thistle for six to eight weeks and the higher rate of clopyralid (LONTREL 360) will provide season long control of Canada thistle. DO NOT use products containing 2,4-D on oats due to the probability of crop injury.
dicamba BANVEL II (480g/L) plus 2,4-D 2,4-D (470g/L) or plus MCPA ESTEMINE MCPA (500g/L)	0.11 to 0.14 kg/ha 0.23 to 0.29 L/ha 0.28 to 0.42 kg/ha 0.60 to 0.89 L/ha 0.28 to 0.42 kg/ha 0.55 to 0.85 L/ha	0.09 to 0.12 L/ac 0.24 to 0.36 L/ac 0.22 to 0.34 L/ac	The 2,4-D or MCPA should be included if mustards are present. Use only the lower rate on barley. Apply to wheat, barley and oats when they are in the 2 to 5 leaf stage. DO NOT use dicamba + 2,4-D on oats.
dicamba/ MCPA DYVEL ((1:4)420g/L)	0.525 kg/ha 1.25 L/ha	0.5 L/ac	Apply when cereals are in the 2 to 5 leaf stage. Hempnettle, corn spurry and cow cockle are controlled best when application is made early in this stage.
dicamba/ MCPA/ mecoprop TARGET (400g/L)	0.4 to 0.6 kg/ha 1 to 1.5 L/ha	0.4 to 0.6 L/ac	Use when wheat or oats are in the 2 to 5 leaf stage or barley in the 2 to 4 leaf stage. Apply when weeds are in the 2 to 3 leaf stage. Use the high rate if weeds are beyond the 3 leaf stage.
dicamba/ MCPA/ mecoprop TARGET (400g/L) plus linuron LOROX DF (50 DF) AFOLAN F (480 g/L) LINURON 480 (480 g/L)	0.4 to 0.6 kg/ha 1 to 1.5 L/ha 0.205 kg/ha 0.41 kg/ha 0.43 L/ha 0.43 L/ha	0.4 to 0.6 L/ac 0.16 kg/ac 0.17 L/ac 0.17 L/ac	Apply when the wheat or barley is in the 2-4 leaf stage. DO NOT apply on oats. May cause temporary yellowing of the lower leaves of wheat and barley.
dichlorprop/ 2,4-D ESTAPROP (582g/L) DICHLORPROP D (582g/L) DIPHENOPROP, SEE (444g/L)	1.017 kg/ha 1.75 L/ha 1.75 L/ha 2.3 L/ha	0.7 L/ac 0.7 L/ac 0.92 L/ac	For spring wheat and barley only. Apply to emerged weeds when the cereals are in the 4 leaf to early flag leaf stage.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
linuron LOROX DF (50 DF) AFOLAN F (480g/L) LINURON 480 (480g/L) plus MCPA MCPA AMINE (500g/L)	0.21 to 0.275 kg/ha 0.42 to 0.55 kg/ha 0.44 to 0.57 L/ha 0.44 to 0.57 L/ha 0.425 to 0.55 kg/ha 0.85 to 1.1 L/ha	 0.17 to 0.22 kg/ac 0.18 to 0.23 L/ac 0.18 to 0.23 L/ac 0.34 to 0.44 L/ac	Apply when weeds are in the 1 to 4 leaf stage and cereals are in the 2 to 4 leaf stage. May cause temporary yellowing of the lower leaves of the crop plants.
MCPA MCPA AMINE (500g/L)	0.35 to 0.85 kg/ha 0.7 to 1.7 L/ha	 0.28 to 0.68 L/ac	Apply when the crop is in the 2 to 5 leaf stage of growth. For hempnettle control, use the high rate of MCPA.
MCPB/MCPA TROPOTOX PLUS (400g/L) CLOVITOX PLUS (400g/L)	1.1 to 1.7 kg/ha 2.75 to 4.25 L/ha 2.75 to 4.25 L/ha	 1.1 to 1.7 L/ac 1.1 to 1.7 L/ac	Apply MCPB/MCPA from the 2 leaf stage to flag leaf stage of cereals.
mecoprop MECOPROP (150g/L) COMPITOX (150g/L)	0.83 to 1.05 kg/ha 5.5 to 7 L/ha 5.5 to 7 L/ha	 2.2 to 2.8 L/ac 2.2 to 2.8 L/ac	Use from the 3-leaf stage to early flag leaf when cereals are 10-15 cm tall. Apply when weeds are in the 2-4 leaf stage. Use the higher rate for more mature weeds.
thifensulfuron-methyl tribenuron-methyl REFINE EXTRA (75 DF) plus 2,4-D 2,4-D (470g/L) or plus MCPA ESTEMINE MCPA (500g/L) plus surfactant AGRAL 90, AGSURF, or CITOWETT PLUS	15 g/ha 20 g/ha 0.42 to 0.55 kg/ha 0.89 to 1.17 L/ha 0.35 to 0.55 kg/ha 0.7 to 1.1 L/ha 2 L/1000L	 8 g/ac 0.35 to 0.47 L/ac 0.28 to 0.44 L/ac 2 L/1000L	DO NOT apply 2,4-D tankmix on oats. Apply tankmixes from the full 3 leaf stage to just before the flagleaf stage of the crop. Always add water soluble packages to clean water with agitator running. DO NOT USE ON LEGER BARLEY AND BELVEDERE WHEAT.
thifensulfuron-methyl tribenuron-methyl REFINE EXTRA (75 DF) plus surfactant AGRAL 90, AGSURF, or CITOWETT PLUS	15 g/ha 20 g/ha 2 L /1000L	 8 g/ac 2 L /1000L	Apply to emerged young actively growing weeds that are less than 10 cm tall or across. Canada thistle, sow thistle and round-leaved mallow are suppressed. Apply when the crop is in the 2 leaf to flag leaf (shot blade) stage. Always add water soluble packages to clear water with agitator running. DO NOT use on Leger Barley and Belvedere Wheat.
diclofop-methyl HOE-GRASS 284 (284g/L) plus bromoxynil PARDNER (280g/L)	0.71 to 0.795 kg/ha 2.5 to 2.8 L/ha 0.28 kg/ha 1 L/ha	 1 to 1.12 L/ac 0.4 L/ac	Do not spray on oats. Apply when the annual grasses are in the 1 to 5 leaf stage, broadleaf weeds in the 1 to 4 leaf stage and when the cereals are in the 2 to early flag leaf stage. Best results are in the 2 to 5 leaf cereal stage since thorough coverage of weed foliage is required for optimum weed control. The higher rate of Hoe Grass must be used to control wild oats in the 4 to 5 leaf stage. Hoe-Grass must only be applied in the 1 to 4 leaf stage of barley and prior to tillering (usually no later then 21 days after emergence of the crop). Application beyond the 4 leaf stage or after tillering may result in barley damage. Reduced grass control will occur if tank mixed with other broadleaf herbicides. Broadleaf herbicide other than bromoxynil (Pardner) must be sprayed 4 days after or before Hoe-Grass.

difenzoquat AVENGE 200C (200g/L) plus 2,4-DB CALIBER 400 (400g/L) COBUTOX 600 (600g/L) EMBUTOX 625 (625g/L)	0.7 to 0.85 kg/ha 3.5 to 4.25 L/ha 1.1 to 1.4 kg/ha 2.75 to 3.5 L/ha 1.8 to 2.3 L/ha 1.75 to 2.25 L/ha	 1.4 to 1.7 L/ac 1.1 to 1.4 L/ac 0.72 to 0.92 L/ac 0.7 to 0.9 L/ac	Do not spray on oats. Use this tank mix to control wild oats and broadleaf weeds. The lower rate of difenzoquat should be used when wild oats density is less then 200 plants/m2. Apply when the wild oats are in the 3 to 5 leaf stage and at the 5 leaf stage to early flag of cereals. DO NOT use when the plants are wet or when the plants are wet or when rain is expected within six hours.
difenzoquat AVENGE 200C (200g/L) plus bromoxynil PARDNER (280g/L)	0.7 to 0.85 kg/ha 3.5 to 4.25 L/ha 0.28 to 0.336 kg/ha 1 to 1.12 L/ha	 1.4 to 1.7 L/ac 0.4 to 0.48 L/ac	Do not spray on oats. Use this tank mix to control wild oats and broadleaf weeds. The lower rate of difenzoquat should be used when wild oats density is less then 200 plants/m2. Apply when the wild oats are in the 3 to 5 leaf stage, broadleaf weeds in the 1 to 4 leaf stage and when the cereals are in the 2 to early flag leaf stage. Best results are in the 2 to 5 leaf cereal stage since thorough coverage of weed foliage is required for optimum weed control. DO NOT use when the plants are wet or when the plants are wet or when rain is expected within six hours.
difenzoquat AVENGE 200C (200g/L) plus bromoxynil/ MCPA BUCTRIL M ((1:1)560g/L)	0.7 to 0.85 kg/ha 3.5 to 4.25 L/ha 0.56 kg/ha 1 L/ha	 1.4 to 1.7 L/ac 0.4 L/ac	Do not spray on oats. Use this tank mix to control wild oats and broadleaf weeds. The lower rate of difenzoquat should be used when wild oats density is less then 200 plants/m2. Apply when the wild oats are in the 3 to 5 leaf stage, broadleaf weeds in the 1 to 4 leaf stage and when the cereals are in the 2 to early flag leaf stage. Wild buckwheat, common ragweed, mustards and lamb's-quarters are controlled up to the 8 leaf stage. Best results are in the 2 to 5 leaf cereal stage since thorough coverage of weed foliage is required for optimum weed control. DO NOT use when the plants are wet or when the plants are wet or when rain is expected within six hours.
difenzoquat AVENGE 200C (200g/L) plus dichlorprop/ 2,4-D ESTAPROP (582g/L)	0.7 to 0.85 kg/ha 3.5 to 4.25 L/ha 1.017 kg/ha 1.75 L/ha	 1.4 to 1.7 L/ac 0.7 L/ac	Do not spray on oats. Use this tank mix to control wild oats and broadleaf weeds. The lower rate of difenzoquat should be used when wild oats density is less then 200 plants/m2. Apply when the wild oats are in the 3 to 5 leaf stage, broadleaf weeds in the 1 to 4 leaf stage and when the cereals are in the 4 to early flag leaf stage. Wild buckwheat, common ragweed, mustards and lamb's-quarters are controlled up to the 8 leaf stage. Best results are in the 2 to 5 leaf cereal stage since thorough coverage of weed foliage is required for optimum weed control. DO NOT use when the plants are wet or when the plants are wet or when rain is expected within six hours.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	1.71 to 4.32 kg/ha 4.75 to 12 L/ha 4.75 to 12 L/ha 1.567 to 3.96 kg/ha 4.75 to 12 L/ha	 1.9 to 4.8 L/ac 1.9 to 4.8 L/ac 1.9 to 4.8 L/ac	For spot treatment of perennials such as field bindweed (at full bloom stage) and Canada thistle, milkweed and common tansy (all in bud to full bloom stage) in standing crop. Apply when the field bindweed has reached full bloom, Canada thistle, milkweed and common tansy are in the bud to full bloom stage. Emerged cereals will be killed by this treatment. To eliminate the possibility of residues in the crop, apply before the cereals have started to show heads.
propanil/ MCPA STAMPEDE CM ((3.6:1)460g/L)	1.267 kg/ha 2.75 L/ha	 1.1 L/ac	Apply when the cereals are in the 2 to 5 leaf stage and weeds are in the 1 to 4 leaf stage. Propanil/MCPA may cause crop yellowing or leaf tip burn but these effects normally disappear in 10 to 14 days.
tralkoxydim ACHIEVE 80DG (80DG) plus bromoxynil PARDNER (280g/L)	0.2 kg/ha 0.25 kg/ha 0.28 to 0.336 kg/ha 1 to 1.12 L/ha	 0.1 kg/ac 0.4 to 0.48 L/ac	Do not spray on oats. Use this tank mix to control wild oats and broadleaf weeds. . Apply when the wild oats are in the 1 to 6 leaf stage, broadleaf weeds in the 1 to 4 leaf stage and when the cereals are in the 2 to early flag leaf stage. Best results are in the 2 to 5 leaf cereal stage since thorough coverage of weed foliage is required for optimum weed control.

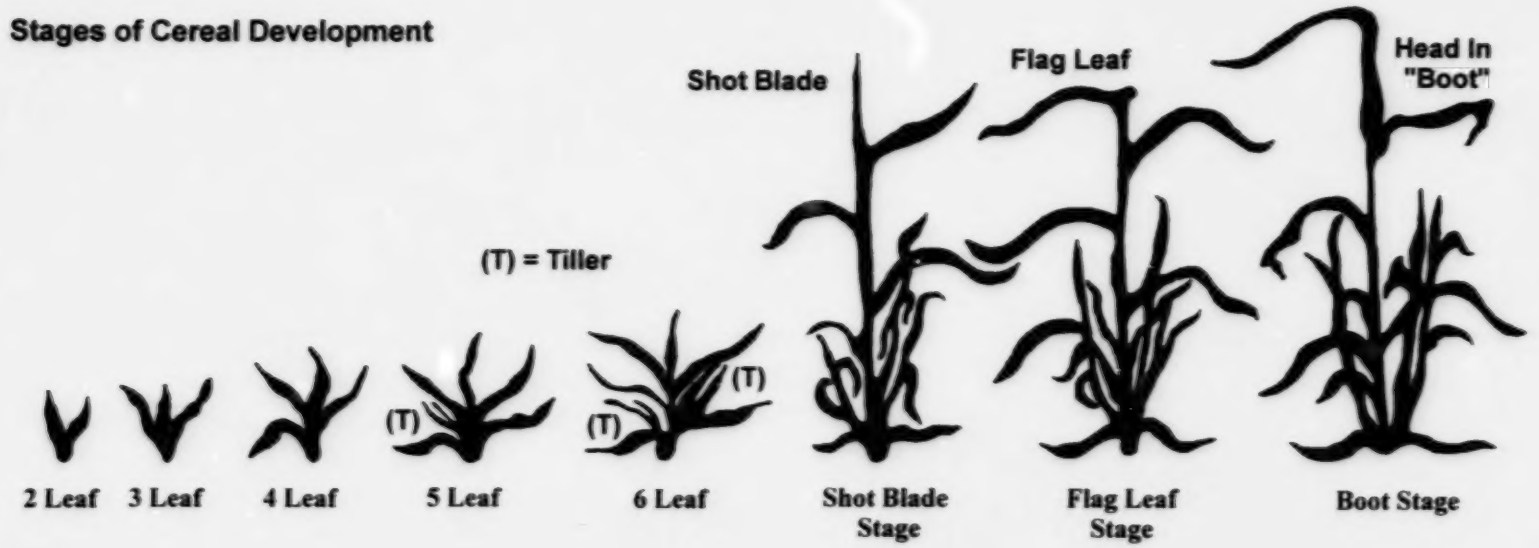
Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see 'Notes on Chemicals' section.)
tralkoxydim ACHIEVE 80DG (80DG) plus bromoxynil/ MCPA BUCTRIL M ((1:1)560g/L)	0.2 kg/ha 0.25 kg/ha 0.56 kg/ha 1 L/ha	 0.1 kg/ac 0.4 L/ac	Do not spray on oats. Use this tank mix to control wild oats and broadleaf weeds. . Apply when the wild oats are in the 1 to 6 leaf stage, broadleaf weeds in the 1 to 4 leaf stage and when the cereals are in the 2 to early flag leaf stage. Wild buckwheat, common ragweed, mustards and lamb's-quarters are controlled up to the 8 leaf stage. Best results are in the 2 to 5 leaf cereal stage since thorough coverage of weed foliage is required for optimum weed control.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.9 kg/ha 2.5 L/ha 2.5 L/ha 0.825 kg/ha 2.5 L/ha	 1 L/ac 1 L/ac 1 L/ac	Use on wheat and barley only. Apply in 50-100 L/ha (20-40 L/ac) water when the crop is at 30% grain moisture or less (consult label for visual indicators). Apply at least 7 days prior to harvest and use ground application only. DO NOT apply to seed crops.
2,4-D/ dicamba/ mecoprop KIL-MOR (485g/L)	0.534 to 0.85 kg/ha 1.1 to 1.75 L/ha	 0.44 to 0.7 L/ac	Apply to actively growing weed foliage. Wait at least 5 days after application before working the area.
dicamba BANVEL II (480g/L)	1.202 kg/ha 2.5 L/ha	 1 L/ac	Apply to actively growing weed foliage at least 2 weeks before a killing frost. Wait at least 3 weeks after application before working the area. Plant only cereals, soybeans or field corn in the year after application.
amitrole AMITROL 240 (231g/L)	3 to 4 kg/ha 12.5 to 16.5 L/ha	 5 to 6.6 L/ac	Apply after harvest to emerged actively growing weeds 10-15 cm tall. Wait 2 weeks after spraying before working the area. DO NOT apply after heavy frost.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.9 kg/ha 2.5 L/ha 2.5 L/ha 0.825 kg/ha 2.5 L/ha	 1 L/ac 1 L/ac 1 L/ac	Use this treatment for a minimum of one season control of quackgrass. Apply in the fall in 50-100 L/ha (20-40 L/ac) water when the quackgrass is actively growing with at least 3 to 4 new leaves on each emerged shoots. Use flat fan nozzles. If higher water volumes are used, the addition of a surfactant such s ENHANCE, or LI700)) is recommended.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	1.71 to 2.52 kg/ha 4.75 to 7 L/ha 4.75 to 7 L/ha 1.567 to 2.31 kg/ha 4.75 to 7 L/ha	 1.9 to 2.8 L/ac 1.9 to 2.8 L/ac 1.9 to 2.8 L/ac	For a minimum of two seasons control of quackgrass, use rates up to 7 L/ha (2.8 L/ac). Apply in the fall in 50-100 L/ha (20-40 L/ac) water when the quackgrass is actively growing with at least 3 to 4 new leaves on each emerged shoots. For Canada thistle, Filed bindweed and other perennial broadleaf weeds, apply to actively growing foliage. Wait at least 3 days after application before working the area. FOR TOUCHDOWN WAIT AT LEAST 5 DAYS AFTER APPLICATION BEFORE WORKING THE AREA.

Wheat (Spring), Oats and Barley Underseeded to Forage Crops

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

diclofop-methyl HOE-GRASS 284 (284g/L)	0.71 to 0.795 kg/ha 2.5 to 2.8 L/ha	 1 to 1.12 L/ac	Do not spray on tame oats. Use in cereals underseeded to alfalfa, and red or sweet clover. Apply when the annual grasses are in the 1 to 5 leaf stage. The higher rate must be used to control wild oats in the 4 to 5 leaf stage. Hoe-Grass must only be applied in the 1 to 4 leaf stage of barley and prior to tillering (usually no later then 21 days after emergence of the crop). Application beyond the 4 leaf stage or after tillering may result in barley damage. Broadleaf herbicides must be sprayed 4 days after or before Hoe-Grass.
difenzoquat AVENGE 200C (200g/L)	0.7 to 0.85 kg/ha 3.5 to 4.25 L/ha	 1.4 to 1.7 L/ac	Do not spray on tame oats. Apply when the wild oats are in the 3 to 5 leaf stage. Use the lower rate when the wild oat stand is less than 200 plants/m2.
tralkoxydim ACHIEVE 80DG plus mineral oil/surfactant TURBOCHARGE	0.2 kg/ha 0.25 kg/ha 0.5 L/100L	 0.1 kg/ac 0.5 L/100L	Do not spray on tame oats. For control of wild oats in cereals underseeded to alfalfa, clover and bird's foot trefoil. Apply at 1 to 6 leaf stage of wild oats. Apply in 110 L/ha water (44 L/ac). Mature straw may be fed to livestock. DO NOT feed or graze underseeded forage in year of treatment. One application per year.
Broadleaf Underseeded Herbicides			
2,4-D * 2,4-D (470g/L)	0.28 to 0.42 kg/ha 0.6 to 0.9 L/ha	 0.24 to 0.36 L/ac	Use only if cereals are underseeded with grasses only. Apply when the forage grasses have at least 2 leaves and cereals are in the 2 to 5 leaf stage.
2,4-DB CALIBER 400 (400g/L) COBUTOX 600 (600g/L) EMBUTOX 625 (625g/L)	1.1 to 1.4 kg/ha 2.75 to 3.5 L/ha 1.8 to 2.3 L/ha 1.75 to 2.25 L/ha	 1.1 to 1.4 L/ac 0.72 to 0.92 L/ac 0.7 to 0.9 L/ac	Use only if cereals are underseeded to alfalfa, bird's foot trefoil, alsike or ladino clover and grasses. Apply in 150 to 200 L/ha water (60-80 L/ac) when the legumes are in the 1 to 4 trifoliate stage. Wild mustard plants are not usually controlled if sprayed when they are beyond the 4 leaf stage. Red clover will be damaged by 2,4-DB.
2,4-DB CALIBER 400 (400g/L) COBUTOX 600 (600g/L) EMBUTOX 625 (625g/L) plus MCPA ESTEMINE MCPA (500 g/L)	0.8 kg/ha 2 L/ha 1.3 L/ha 1.25 L/ha 35 g/ha 70 mL/ha	 0.8 L/ac 0.52 L/ac 0.5 L/ac 28 mL/ac	Use only if cereals are underseeded to alfalfa, bird's foot trefoil, alsike or ladino clover and grasses. The addition of MCPA gives better control of common mustard than 2,4-DB alone. Apply in 150 to 200 L/ha water (60-80 L/ac). Apply when the legumes are in the 1 to 4 leaf stage.
MCPA ESTEMINE MCPA (500g/L)	0.28 to 0.55 kg/ha 0.55 to 1.1 L/ha	 0.22 to 0.44 L/ac	Use only if cereals are underseeded with grasses only. Apply when the forage grasses have at least 2 leaves and cereals are in the 2 to 5 leaf stage.
MCPA MCPA SODIUM 300 (300g/L)	0.3 to 0.45 kg/ha 1 to 1.5 L/ha	 0.4 to 0.6 L/ac	Use only if cereals are underseeded to red clover. Treat at an early stage of development of the clover when it is covered by a canopy of weeds and crop. Apply in 180 to 240 L/ha water (72-96 L/ac). The lower rate may not kill ragweed.
MCPB/MCPA (15:1) TROPOTOX PLUS (400g/L) CLOVITOX PLUS (400g/L)	1.1 to 1.7 kg/ha 2.75 to 4.25 L/ha 2.75 to 4.25 L/ha	 1.1 to 1.7 L/ac 1.1 to 1.7 L/ac	Use only if cereals are underseeded to red, alsike, ladino or white dutch clover and grasses. Apply in 150 to 200 L/ha water (60-80 L/ac) when legumes are in the unifoliate to the 4th trifoliate leaf stage.
Postemergent Grass and Broadleaf Herbicides			

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
difenzoquat	0.7 to 0.85 kg/ha		Do not spray on tame oats. Use only if cereals are underseeded to alfalfa, bird's foot trefoil, alsike or ladino clover and grasses. Use this tank mix to control wild oats and broadleaf weeds. The lower rate of difenzoquat should be used when wild oats density is less then 200 plants/m2. Apply when the wild oats are in the 3 to 5 leaf stage and at the 5 leaf stage to early flag of cereals. DO NOT use when the plants are wet or when the plants are wet or when rain is expected within six hours.
AVENGE 200C (200g/L)	3.5 to 4.25 L/ha	1.4 to 1.7 L/ac	
plus 2,4-DB	1.1 to 1.4 kg/ha		
CALIBER 400 (400g/L)	2.75 to 3.5 L/ha	1.1 to 1.4 L/ac	
COBUTOX 600 (600g/L)	1.8 to 2.3 L/ha	0.72 to 0.92 L/ac	
EMBUTOX 625 (625g/L)	1.75 to 2.25 L/ha	0.7 to 0.9 L/ac	
glyphosate	1.71 to 4.32 kg/ha		For spot treatment of perennials such as field bindweed (at full bloom stage) and Canada thistle, milkweed and common tansy (all in bud to full bloom stage) in standing crop. Emerged crop plants will be killed by this treatment. DO NOT apply after the cereals have started to show heads. DO NOT harvest forage from the treated areas until the treated plants have turned brown. Apply at least 6 hours before rain.
ROUNDUP TRANSORB (360g/L)	4.75 to 12 L/ha	1.9 to 4.8 L/ac	
GLYFOS (360g/L)	4.75 to 12 L/ha	1.9 to 4.8 L/ac	
tralkoxydim	0.2 kg/ha		Use on cereals underseeded to alfalfa only. DO NOT apply prior to the five leaf stage of the cereal crop as temporary injury may occur. Use in a minimum of 125 L/ha water (50 L/ac). DO NOT use on tame oats. Avoid drift onto oats or corn crops. DO NOT use on other forages legumes or grasses.
ACHIEVE 80DG (80 DG)	0.25 kg/ha	0.1 kg/ac	
plus 2,4-DB	1.1 to 1.25 kg/ha		
CALIBER 400 (400g/L)	2.75 to 3.125 L/ha	1.1 to 1.25 L/ac	
COBUTOX 600 (600g/L)	1.8 to 2.1 L/ha	0.72 to 0.84 L/ac	
EMBUTOX 625 (625g/L)	1.75 to 2 L/ha	0.7 to 0.8 L/ac	
plus mineral oil/surfactant			
TURBOCHARGE	0.5 L/100L	0.5 L/100L	



Notes:

Weed control ratings are given as 0-9 where 0 indicates no control and 9 indicates 90%-100% control under ideal conditions.

Ratings are subjective values based on best available information and give general comparisons based on use as descibed in this guide.

Under unfavorable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used.

Ratings in **BOLD** suggest the weed is listed on the product label for control or suppression.

Please see product label for more information on registered weed species, product uses and precautions.

Table 15. Spring Cereal Herbicide Weed Control Ratings

		Crop			Annual Grasses								Annual Broadleaves																				Perennial Weeds												
Treatment	**Trade Name**	oats	spring barley	spring wheat	barnyard grass	crabgrass	fall panicum	foxtail, green	foxtail, yellow	old witch grass	proso millet	wild oats	buckwheat, wild	cocklebur	chickweed, common	corn spurry	hempnettle	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	shepherd's purse	stinkweed	velvetleaf	bindweed, field	chickweed, mouse-eared	curled dock	dandelion	ground-ivy (creeping-charlie)	horsetail	mallow	milkweed	nutsedge	plantains	quackgrass	sow-thistle	thistle, Canada	vetches				
postemergence grass herbicides																																													
diclofop-methyl	HOE-GRASS 284		✓	✓	**8**	?	?	**8**	**8**	?	?	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
difenzoquat	AVENGE 200C		✓	✓	?	?	?	?	?	?	?	**9**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
tralkoxydim	ACHIEVE 80DG		✓	✓	**2**	?	?	**9**	**9**	?	?	**9**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
triallate	AVADEX BW		✓	✓	?	?	?	?	?	?	?	**8**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
postemergence broadleaf herbicides																																												
2,4-D	2,4-D*	✓	✓	✓	0	0	0	0	0	0	0	0	**7**	**8**	**7**	2	2	**7**	**9**	**9**	7	**9**	**9**	**9**	**9**	**8**	**7**	**?**	**7**	**8**	?	2	4	6	0	**8**	0	**5**	**8**	5				
2,4-D/ dicamba /mecoprop	KIL-MOR	✓	✓	✓	0	0	0	0	0	0	0	0	**9**	**8**	?	**9**	?	**9**	**9**	**9**	**8**	**9**	**9**	?	?	**8**	**8**	?	?	?	?	2	?	0	0	?	0	**8**	**8**	?				
2,4-DB	2,4-DB*	✓	✓	✓	0	0	0	0	0	0	0	0	6	9	2	2	2	7	**9**	**9**	7	**9**	**9**	8	**6**	8	?	2	6	5	?	2	2	0	0	8	0	5	?	2				
bromoxynil	PARDNER	✓	✓	✓	0	0	0	0	0	0	0	0	**8**	**8**	2	2	2	**8**	**9**	**7**	**9**	**7**	**9**	**8**	**8**	**9**	5	?	?	?	?	0	?	0	0	?	0	6	5	?				
bromoxynil /MCPA (1:1)	BUCTRIL M	✓	✓	✓	0	0	0	0	0	0	0	0	**9**	**8**	?	2	7	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	7	?	?	?	?	7	?	0	0	?	0	**7**	**7**	?				
clopyralid	LONTREL		✓	✓	0	0	0	0	0	0	0	0	**8**	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	**9**	?	?	?	?	?	?	**9**	**9**	9				
dicamba	BANVEL II	✓	✓	✓	0	0	0	0	0	0	0	0	**9**	9		**9**	7	**9**	**9**	7	9	**9**	**9**	6	6	9	8	?	9	8	?	0	?	0	0	?	0	**9**	**8**	5				
dicamba/MCPA	DYVEL	✓	✓	✓	0	0	0	0	0	0	0	0	**9**	?	?	**9**	**8**	**9**	**9**	**9**	?	**9**	**9**	**9**	**9**	?	8	?	?	?	?	?	?	?	?	?	0	**8**	**8**	?				
dicamba/ MCPA /mecoprop	TARGET	✓	✓	✓	0	0	0	0	0	0	0	0	**9**	?	?	**9**	**8**	**8**	**9**	**9**	?	**9**	**9**	**9**	**9**	?	**8**	?	?	?	?	?	?	?	?	?	0	**8**	**8**	?				
dichlorprop /2,4-D	ESTAPROP, DICHLORPROP-D, DIPHENOPROP		✓	✓	0	0	0	0	0	0	0	0	**8**	?	?	2	7	**8**	**9**	**9**	?	**9**	**9**	**9**	**9**	?	7	?	?	?	?	2	?	?	?	?	0	8	**8**	?				
linuron + MCPA	LOROX + MCPA*	✓	✓	✓	?	?	?	?	?	?	?	?	**0**	9	**8**	**9**	**9**	**9**	**9**	9	?	**9**	**9**	?	?	?	?	8	?	?	?	?	?	?	?	?	?	?	?	?				

Table 15. Spring Cereal Herbicide Weed Control Ratings

		Crop			Annual Grasses								Annual Broadleaves														Perennial Weeds													
Treatment	Trade Name	oats	spring barley	spring wheat	barnyard grass	crabgrass	fall panicum	foxtail, green	foxtail, yellow	old witch grass	proso millet	wild oats	buckwheat, wild	cocklebur	chickweed, common	corn spurry	hempnettle	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	shepherd's purse	stinkweed	velvetleaf	bindweed, field	chickweed, mouse-eared	curled dock	dandelion	ground-ivy (creeping-charlie)	horsestail	mallow	milkweed	nutsedge	plantains	quackgrass	sow-thistle	thistle, Canada	vetches
MCPA	MCPA*	✓	✓	✓	0	0	0	0	0	0	0	0	2	7	?	7	8	2	9	9	?	9	9	9	9	8	7	?	?	?	?	8	?	0	0	?	0	7	7	5
MCPB/MCPA (15:1)	TROPOTOX PLUS, CLOVITOX PLUS	✓	✓	✓	0	0	0	0	0	0	0	0	2	?	2	2	8	2	9	9	?	9	8	9	9	9	8	?	?	?	?	?	?	?	0	?	0	9	9	5
mecoprop	MECOPROP, COMPITOX	✓	✓	✓	0	0	0	0	0	0	0	0	2	?	9	9	2	2	9	9	?	9	9	?	7	?	?	9	?	?	?	?	?	?	?	?	0	?	7	5
propanil/MCPA	STAMPEDE CM	✓	✓	✓	?	?	?	8	8	?	?	2	8	?	7	?	?	8	9	9	?	9	9	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
thifensulfuron-methyl/ tribenuron-methyl	REFINE EXTRA	✓	✓	✓	0	0	0	0	0	0	0	0	9	?	?	9	9	9	9	8	?	9	2	9	9	?	2	?	?	?	?	?	?	?	?	?	0	8	8	?

* Various formulations available, see Table 1.

? Insufficient information available to make a rating

Wheat (Winter) and Fall Rye

Apply all treatments in 100 to 200 L/ha (40-80 L/ac) water except where otherwise noted.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

Soil Applied Grass Herbicides

trifluralin	0.383 to 0.546 kg/ha		For loose silky bentgrass control in the fall. Apply as soon as possible after planting. Incorporate shallowly into the soil surface with drag harrows. Seed the crop approx. 5 cm deep to separate the germinating seed from the chemical.
BONANZA 400 (400g/L)	0.96 to 1.37 L/ha	0.38 to 0.55 L/ac	
TREFLAN (480g/L)	0.8 to 1.14 L/ha	0.32 to 0.46 L/ac	
RIVAL DF (60 DF)	0.64 to 0.91 kg/ha	0.26 to 0.36 kg/ac	

Postemergent Grass Herbicides

diclofop-methyl	0.71 to 0.795 kg/ha		Do not spray on tame oats. Use in cereals underseeded to alfalfa, and red or sweet clover. Apply when the annual grasses are in the 1 to 5 leaf stage. The higher rate must be used to control wild oats in the 4 to 5 leaf stage. Hoe-Grass must only be applied in the 1 to 4 leaf stage of barley and prior to tillering (usually no later then 21 days after emergence of the crop). Application beyond the 4 leaf stage or after tillering may result in barley damage. Broadleaf herbicides must be sprayed 4 days after or before Hoe-Grass.
HOE-GRASS 284 (284g/L)	2.5 to 2.8 L/ha	1 to 1.12 L/ac	
diclofop-methyl	1 kg/ha		Apply in the fall to loose silky bentgrass at the 1 to 4 leaf stage in winter wheat or fall rye.
HOE-GRASS 284 (284g/L)	3.5 L/ha	1.4 L/ac	
tralkoxydim	0.2 kg/ha		For the control of wild oats, apply when at the 1 to 6 leaf stage. DO NOT use on rye. Apply in 110 L/ha water (44 L/ac). Herbicides not listed on the label may be applied separately 7 days after application of ACHIEVE 80DG. Wild oat control will be reduced if REFINE EXTRA is applied before ACHIEVE 80DG. DO NOT tankmix REFINE EXTRA with ACHIEVE 80DG. Mature straw may be fed to livestock. One application per year.
ACHIEVE 80DG (80 DG)	0.25 kg/ha	0.1 kg/ac	
plus mineral oil/surfactant			
TURBOCHARGE	0.5 L/100L	0.5 L/100L	

Postemergent Broadleaf Herbicides

2,4-D *	0.35 to 0.55 kg/ha		Treat in the spring when the crop growth begins until the early shotblade stage. For control of winter annuals apply early before flower buds appear on the weeds.
2,4-D (470g/L)	0.75 to 1.17 L/ha	0.3 to 0.47 L/ac	
2,4-D/ dicamba/ mecoprop	0.413 to 0.534 kg/ha		Apply in early spring when winter annual weeds are in the rosette stage. Apply before the crop is more than 30 cm high (top leaf extended). DO NOT USE ON RYE.
KIL-MOR (485g/L)	0.85 to 1.1 L/ha	0.34 to 0.44 L/ac	
bromoxynil	0.28 to 0.336 kg/ha		Winter wheat may be treated from the 2 to 4 leaf stage in the fall or from the time growth begins to early flag leaf stage in the spring. More effective on winter annuals when applied as a fall treatment.
PARDNER (280g/L)	1 to 1.2 L/ha	0.4 to 0.48 L/ac	
bromoxynil/ MCPA	0.56 kg/ha		Winter wheat may be treated from the 2 to 4 leaf stage in the fall or from the 2 to early leaf flag stage in the spring.
BUCTRIL M ((1:1)560g/L)	1 L/ha	0.4 L/ac	

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
bromoxynil/ MCPA BUCTRIL M ((1:1)560g/L) plus thifensulfuron-methyl/ tribenuron-methyl REFINE EXTRA (75DF) plus surfactant AGRAL 90, AGSURF, or CITOWETT PLUS	0.56 kg/ha 1 L/ha 5 g/ha 6.7 g/ha 2L/1000L	 0.4 L/ac 2.7 g/ac 2L/1000L	Improved control of chickweed and hempnettle up to the 6 leaf stage with the addition of REFINE EXTRA. Control of chickweed may be reduced if the plants are past the 6 leaf stage and flowering at time of application .
dicamba BANVEL II (480g/L)	0.11 to 0.139 kg/ha 0.23 to 0.29 L/ha	 0.09 to 0.12 L/ac	Apply in the spring when the crop is 15 to 25 cm tall before the shotblade stage. Can be used with 2,4-D or MCPA amine 0.42 kg/ha (0.84 L/ha (0.33 L/ac) of 500 g/L formulations). The addition of 2,4-D or MCPA will give improved control of pepper-grass, shepherd's purse and pennycress. DO NOT USE ON FALL RYE.
dicamba/ MCPA DYVEL ((1:4)420g/L)	0.505 kg/ha 1.2 L/ha	 0.48 L/ac	Apply to winter wheat in the spring when weeds have emerged and the crop is 15 to 25 cm tall before the shotblade stage. DO NOT USE ON RYE.
dicamba/ MCPA/ mecoprop TARGET (400g/L)	0.4 to 0.6 kg/ha 1 to 1.5 L/ha	 0.4 to 0.6 L/ac	Apply in spring before the crop is more than 30 cm high (top leaf extended). Winter annuals should be sprayed as soon as new growth starts. Apply when other weeds are in the 2 to 3 leaf stage. DO NOT USE ON RYE.
dichlorprop/ 2,4-D ESTAPROP (582g/L) DICHLORPROP D (582g/L)	1.017 kg/ha 1.75 L/ha 1.75 L/ha	 0.7 L/ac 0.7 L/ac	Apply in early spring to emerged weeds. May be used until cereals are up to the flag leaf stage.
MCPA MCPA AMINE (500g/L)	0.35 to 0.85 kg/ha 0.7 to 1.7 L/ha	 0.28 to 0.68 L/ac	Treat in the spring when the crop growth begins until the early shotblade stage. For control of winter annuals apply early before flower buds appear on the weeds.
mecoprop MECOPROP (150g/L) COMPITOX (150g/L)	0.83 to 1.05 kg/ha 5.5 to 7 L/ha 5.5 to 7 L/ha	 2.2 to 2.8 L/ac 2.2 to 2.8 L/ac	Use from the 3 leaf stage to early flag leaf when cereals are 10-15 cm tall. Apply when weeds are in the 2-4 leaf stage. Use the higher rate for more mature weeds.
thifensulfuron- methyl tribenuron methyl REFINE EXTRA (75DF) plus 2,4-D 2,4-D (470g/L) or MCPA ESTEMINE MCPA (500g/L) plus surfactant AGRAL 90, AGSURF, or CITOWETT PLUS	15 g/ha 20 g/ha 0.42 to 0.55 kg/ha 0.89 to 1.17 L/ha 0.35 to 0.55 kg/ha 0.7 to 1.1 L/ha 2 L/1000L	 8 g/ac 0.36 to 0.47 L/ac 0.28 to 0.44 L/ac 2 L/1000L	Apply tankmixes from the full 3 leaf stage to just before the flag leaf stage of the crop. Always add water soluble packages to clean water with agitator running. DO NOT USE ON RYE.

thifensulfuron- methyl/ tribenuron methyl REFINE EXTRA (75 DF) plus surfactant AGRAL 90, AGSURF, or CITOWETT PLUS	15 g/ha 20 g/ha 2 L/1000L	 8 g/ac 2 L/1000L	Apply to emerged young actively growing weeds that are less than 10 cm tall or across. Canada thistle, sow thistle and round-leaved mallow are suppressed. Apply when the crop is in the 2 leaf to flag leaf (shot blade) stage. Always add water soluble packages to clear water with agitator running. DO NOT USE ON RYE.
Postemergent Grass and Broadleaf Herbicides			
diclofop-methyl HOE-GRASS 284 (284g/L) plus bromoxynil PARDNER (280g/L)	0.71 to 0.795 kg/ha 2.5 to 2.8 L/ha 0.28 to 0.336 kg/ha 1 to 1.2 L/ha	 1 to 1.12 L/ac 0.4 to 0.48 L/ac	For spring treatment from the time winter wheat growth begins until early flag leaf. Apply when the annual grasses are in the 1 to 5 leaf stage, broadleaf weeds in the 1 to 4 leaf stage. The higher rate of Hoe Grass must be used to control wild oats in the 4 to 5 leaf stage. Broadleaf herbicide other than bromoxynil (Pardner) must be sprayed 4 days after or before Hoe-Grass.
tralkoxydim ACHIEVE 80DG (80DG) plus bromoxynil PARDNER (280g/L)	0.2 kg/ha 0.25 kg/ha 0.28 to 0.336 kg/ha 1 to 1.2 L/ha	 0.1 kg/ac 0.4 to 0.48 L/ac	Use this tank mix to control wild oats and broadleaf weeds. Apply when the wild oats are in the 1 to 6 leaf stage and when the winter wheat is in the 2 to 4 leaf stage in the fall and in the 2 to early flag leaf stage in the spring. More effective on winter annuals when applied in the fall.
tralkoxydim ACHIEVE 80DG (80DG) plus bromoxynil/ MCPA BUCTRIL M ((1:1)560g/L)	0.2 kg/ha 0.25 kg/ha 0.56 kg/ha 1 L/ha	 0.1 kg/ac 0.4 L/ac	Use this tank mix to control wild oats and broadleaf weeds. Apply when the wild oats are in the 1 to 6 leaf stage and when the winter wheat is in the 2 to 4 leaf stage in the fall and in the 2 to early flag leaf stage in the spring.
Preharvest			
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.9 kg/ha 2.5 L/ha 2.5 L/ha 0.83 kg/ha 2.5 L/ha	 1 L/ac 1 L/ac 1 L/ac	Use on wheat only. Apply in 50-100 L/ha (20-40 L/ac) water when the crop is at 30% grain moisture or less (consult label for visual indicators). Apply at least 7 days prior to harvest and use ground application only. DO NOT apply to seed crops.

Wheat (Winter) and Fall Rye Underseeded To Clovers

Apply all treatments in 100 to 200 L/ha (40-80 L/ac) water except where otherwise noted.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

Postemergent Grass Herbicides			
tralkoxydim ACHIEVE 80DG (80 DG) plus mineral oil/surfactant TURBOCHARGE	0.2 kg/ha 0.25 kg/ha 0.5 L/100L	 0.1 kg/ac 0.5 L/100L	For the control of wild oats, apply when at the 1 to 6 leaf stage. DO NOT use on rye. Apply in 110 L/ha water (44 L/ac). Mature straw may be fed to livestock. DO NOT feed or graze underseeded forage in year of treatment. One application per year.
Postemergent Broadleaf Herbicides			

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
bromoxynil/ MCPA BUCTRIL M ((1:1)560g/L)	0.56 kg/ha 1 L/ha	 0.4 L/ac	Apply in the spring when the red clover is in the 1st to 3rd trifoliate stage and when the winter wheat provides a protective canopy over the clover. DO NOT use on rye. Apply in not less than 200 L/ha water (80 L/ac). DO NOT apply if clover is under stress, and avoid overlaps as injury to the red clover may result.
MCPA MCPA SODIUM 300 (300g/L)	0.3 to 0.45 kg/ha 1 to 1.5 L/ha	 0.4 to 0.6 L/ac	Apply in the spring when crop growth commences until early shotblade stage. Treat when the legumes are in an early stage of development and covered by a canopy of weeds and crop. Apply in 180-240 L/ha water (72-96 L/ac).
MCPB/MCPA TROPOTOX PLUS (400g/L) CLOVITOX PLUS (400g/L)	1.1 to 1.7 kg/ha 2.75 to 4.25 L/ha 2.75 to 4.25 L/ha	 1.1 to 1.7 L/ac 1.1 to 1.7 L/ac	Apply in the spring when the cereal crop is in the 2 leaf to flag leaf stage, and the weeds are small and actively growing. Legumes should be in the 1 to 3 trifoliate stage. Use 150 to 200 L/ha water (60-80 L/ac).

Notes:

Weed control ratings are given as 0-9 where 0 indicates no control and 9 indicates 90%-100% control under ideal conditions.

Ratings are subjective values based on best available information and give general comparisons based on use as descibed in this guide.

Under unfavorable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used.

Ratings in **BOLD** suggest the weed is listed on the product label for control or suppression.

Please see product label for more information on registered weed species, product uses and precautions.

Table 16. Winter Wheat And Fall Rye Herbicide Weed Control Ratings

		Annual Grasses								Annual Broadleaves																Perennial Weeds											
Treatment	**Trade Name**	barnyard grass	crabgrass	fall panicum	foxtail, green	foxtail, yellow	old witch grass	proso millet	wild oats	buckwheat, wild	cocklebur	chickweed, common	cleavers	corn spurry	hempnettle	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	shepherd's purse	stinkweed	velvetleaf	bindweed, field	chickweed, mouse-eared	curled dock	dandelion	horsestail	mallow	milkweed	nutsedge	plantains	quackgrass	sow-thistle	thistle, Canada	vetches
postemergence grass herbicides																																					
diclofop-methyl	HOE-GRASS 284	**8**	?	?	**8**	**8**	?	?	**9**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
tralkoxydim	ACHIEVE 80DG	**2**	?	?	**8**	**8**	?	?	**9**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
trifluralin	TREFLAN	**9**	**9**	9	**9**	**9**	9	7	**8**	**5**	2	?	?	?	5	2	**8**	2	2	**8**	2	?	?	2	2	?	0	0	2	?	2	2	?	2	2	2	?
postemergence broadleaf herbicides																																					
2,4-D	2,4-D*	0	0	0	0	0	0	0	0	**7**	**8**	**7**	?	2	2	**7**	**9**	**9**	7	**9**	**9**	**9**	**9**	**8**	**7**	?	**7**	**8**	0	?	6	0	?	0	?	**8**	?
2,4-D/ dicamba/ mecoprop	KIL-MOR	0	0	0	0	0	0	0	0	**9**	**8**	?	?	**9**	?	**9**	**9**	**9**	**8**	**9**	**9**	?	?	**8**	**8**	?	?	?	0	?	0	0	?	0	8	8	?
2,4-D/dichlorprop	ESTAPROP, DICHLORPROP-D, DIPHENOPROP	0	0	0	0	0	0	0	0	**8**	?	?	?	2	7	**8**	**9**	**9**	?	**9**	**9**	**9**	**9**	?	7	?	?	?	?	?	?	?	?	0	8	**8**	?
bromoxynil	PARDNER[1]	0	0	0	0	0	0	0	0	**8**	**8**	2	?	**2**	2	**8**	**9**	**7**	**9**	**7**	**9**	8	8	**9**	5	?	?	?	0	?	0	0	?	0	6	5	?
bromoxynil/MCPA	BUCTRIL M[1]	0	0	0	0	0	0	0	0	**9**	**9**	?	?	2	7	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**9**	7	?	?	?	7	?	0	0	?	0	7	7	?
dicamba	BANVEL II	0	0	0	0	0	0	0	0	**9**	9	?	?	**9**	7	**9**	9	7	9	9	9	6	6	9	8	?	9	8	0	?	0	0	?	0	**9**	**8**	?
dicamba/ MCPA/ mecoprop	TARGET	0	0	0	0	0	0	0	0	**9**	?	?	?	**9**	**8**	**8**	**9**	**9**	?	**9**	**9**	**9**	**9**	**9**	**8**	?	?	?	?	?	?	?	?	0	**8**	**8**	?
MCPA	MCPA*	0	0	0	0	0	0	0	0	2	**7**	?	?	**7**	**8**	**2**	**9**	**9**	?	**9**	**9**	**9**	**9**	**8**	7	?	?	?	8	?	0	0	?	0	7	7	?
MCPB/MCPA (15:1)	TROPOTOX PLUS, CLOVITOX PLUS[1]	0	0	0	0	0	0	0	0	2	?	2	?	2	8	2	**9**	**9**	?	**9**	**8**	**9**	**9**	**9**	8	?	?	?	?	?	?	0	?	0	**9**	**9**	?
mecoprop	MECOPROP, COMPITOX	0	0	0	0	0	0	0	0	2	?	?	?	**9**	2	2	**9**	**9**	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	**?**	0	?	**7**	?
thifensulfuron-methyl/ tribenuron-methyl	REFINE EXTRA	0	?	?	0	0	?	?	0	**9**	?	?	?	**9**	**9**	9	**9**	**8**	?	**9**	2	**9**	**9**	?	2	?	?	?	?	?	?	?	?	?	0	**8**	**8**	?

* Various formulations available, see Table 1.

? Insufficient information available to make a rating

[1] Can be used as a fall or spring treatment. All other treatments are for spring only.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)

Horticultural Crops

Vegetable, fruit and ornamental crops number in excess of more than 50 crops. Some are seeded, some transplanted, some are annuals, other crops are perennial, presenting a very diverse group of situations to manage weeds.

Perennial weeds are often a more severe problem in perennial horticultural crops such as asparagus, berry crops, fruit crops and ornamentals (perennials). Quackgrass, bindweed, thistles, horsetail, dandelions, etc. should be controlled before these crops are planted.

Recommendations for some horticultural crops such as snap beans or sweet corn will be found in the field crop section because they are similar to those for field corn and field beans. Differences are noted where necessary.

Treatments listed for horticultural crops in the publication are based on extensive research trials. Herbicides should not be used in cold frames or greenhouses unless specifically recommended.

Weed management involves all aspects of weed control in horticultural crops including herbicides, cultivation, hoeing, mulches, weed prevention, etc.

Horticultural crops are often high value crops. Weed competition is costly. Improper application of herbicides also can be costly. Sprayers used for hormone type herbicides (2,4-D, etc.) should not be used to apply insecticides, fungicides or other herbicides on susceptible horticultural crops.

WEED CONTROL IN GARDENS

Many garden plants can be killed or damaged by the chemicals used to kill weeds. The frequent use of a hoe, or other s. ow cultivation, is the most practical method of controlling weeds in gardens. Most annual weeds can be killed with one or two cultivations. Perennial weeds can be controlled by any kind of cultivation which removes all top growth at frequent intervals. After the food stored in the roots has been used, the weeds will die.

When it is possible to apply the chemical to one kind of garden plant, without danger of spray or dust drifting onto susceptible garden plants, one of the chemicals recommended in this publication may be used. (Check list below.) Granular formulations can be applied using a jam jar with a perforated top. This "salt shaker" method, after a little practice, is effective and quick. A small compressed air sprayer can be used to apply any liquid or wettable powder which is mixed with water. It is important that the correct amount be applied. One way of ensuring accuracy is to fill the garden sprayer with water to a mark - apply the spray to 100 m² taking care to apply it as evenly as possible, and then measure the amount of water used. Add the chemical recommended in the publication to this amount of water for each 100 m² treated.

As a guide in converting the recommended rate of any chemical to the amount required for a small area, 32 g per 100 m² is approximately equal to 3.25 kg/ha. For liquid measure, 2 level tbs is approximately 28 mL. One L of spray mixture per 100 m² is equal to 100 L/ha.

The herbicides listed under each crop are available for farm, custom spraying, and industrial use. The Ontario Pesticides Act restricts the sale of herbicides to the home gardener to those with a domestic label.

Vegetable Crops

PREPLANT WEED AND COVER CROP CONTROL

Cover crops and emerged weeds which must be controlled before a vegetable crop is seeded or transplanted are usually controlled with glyphosate (0.75 to 3.5 L/ha) a translocated systemic herbicide, with paraquat (GRAMOXONE) or diquat (REGLONE) at 3.0 to 5.5. L/ha (1.2-2.2 L/ac), both contact, non-systemic herbicides or with glufosinate ammonium (IGNITE) at 2.7 to 5.0 L/ha (1.08-2 L/ac), a minimal translocation, mostly contact, non-systemic herbicide. All four herbicides are non-residual. Glyphosate (ROUNDUP or TOUCHDOWN) can be used before planting any vegetable crops. Paraquat (GRAMOXONE) or diquat (REGLONE) are registered for preplant use on beans, beets, carrots, cole crops, onions, peas, potatoes, sweet corn and rutabagas. Glufosinate ammonium (IGNITE) is registered

for preplant use on carrot, lettuce and onions only.

A stale seedbed technique involves preparing a seedbed early in the growing season, controlling emerged weeds several weeks later with glyphosate, paraquat, diquat or glufosinate ammonium, then seeding or transplanting vegetable crops trying to prevent disturbing the soil as little as possible to delay the emergence of new crop of weeds.

Alternatively, a grower may choose to kill the cover crop or/and emerged weeds just before planting the vegetable crop and either till the area or leave seedbed untilled.

Inter-row weeding with a contact herbicide such as paraquat (3 to 5.5 L/ha (1.2-2.2 L/ac) (product) in 250 to 1000 L/ha (100-400 L/ac) water) can be used as a rescue operation where other methods of weed control have failed. The herbicide is directed between the crop rows onto the emerged weeds. Use special low pressure (7 to 15 kPa) applicators such as dribble bars or vibra jets equipped with shields to prevent wetting the crop. This technique of weeding with paraquat is registered for use on beans, beets, carrots, cole crops, cucumbers, lettuce, onions, potatoes, sweet corn and tomatoes.

PREPLANTING TREATMENTS

Preplanting treatments are applied before the crop is sown or planted. Some of these herbicides kill seedlings soon after germination while others also kill weed seeds. Most herbicides used for these treatments must be thoroughly incorporated in the soil by cultivation soon after application. Check the label.

SELECTIVE PREEMERGENCE HERBICIDES

These materials prevent emergence of many weed seedlings without reducing crop stand. This type of material should be applied immediately after seeding or at least before the emergence of the crop. If these materials are applied after weeds have emerged, kill is usually poor. Best results are obtained with this method when conditions for weed seed germination are good.

SELECTIVE POSTEMERGENCE HERBICIDES

These chemicals are applied after the crop plants have sprouted, or after the crop has been transplanted. Applied as directed, the weeds can be killed without injury to the crop. The weeds should be small for best results.

Asparagus

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

[illegible] of Direct-Seed Asparagus ([illegible]

glufosinate ammonium	0.405 to 0.75 kg/ha		Apply in 110-330 L/ha (44-132 L/ac) water. Spray on emerged weeds prior to emergence of the crop.
IGNITE (150g/L)	2.7 to 5 L/ha	1.08 to 2 L/ac	Weeds which have not emerged will not be controlled. Ensure uniform coverage. See label for more detailed information.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
paraquat GRAMOXONE (200g/L) followed by napropamide DEVRINOL DF (50 DF)	0.6 to 1.1 kg/ha 3 to 5.5 L/ha 2.25 to 4.5 kg/ha 4.5 to 9 kg/ha	 1.2 to 2.2 L/ac 1.8 to 3.6 kg/ac	Apply in 300 to 1100 L/ha (120-440 L/ac) water. Spray on emerged weeds before crop emergence. Apply preemergence treatment to next crop of weeds. Direct seeding of asparagus is only practical if weeds can be controlled from the time of seeding until the asparagus plants develop an extensive root system. Paraquat can be used as a "chemical mower" to kill emerged seedling weeds when the first asparagus seedlings are beginning to emerge. To note development, monitor germination progress of asparagus by frequent examination of germinating seeds. Soon after this application, the napropamide preemergence treatment should be made to extend the period of weed control. To be effective, this must be separate applications.
terbacil SINBAR (80 WP)	0.3 kg/ha 0.38 kg/ha	 0.15 kg/ac	Plant asparagus seed into newly cultivated fields, where no weeds have emerged. Asparagus seed should be planted to a depth of 4 cm in coarse (sandy) soils, or 2.5 cm deep in fine (clay) soils. Within 2 days of planting, apply a preemergent broadcast application of SINBAR at a rate of 0.38 kg/ha (0.15 kg/ac). See label for more details.
[illegible] (Soil Applied Grass Herbicides)			
fluazifop-p-butyl FUSILADE II (125g/L)	0.075 to 0.25 kg/ha 0.6 to 2 L/ha	 0.24 to 0.8 L/ac	Apply at 0.6 L/ha (0.24 L/ac) at 2-5 leaf stage of annual grasses. Apply at 0.8 L/ha (0.32 L/ac) at 2-5 leaf stage of volunteer wheat and barley. Apply at 1 to 2 L/ha (0.4-0.8 L/ac) at 3-5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. Inter-row cultivation should not occur until 5 days after application.
[illegible] (Soil Applied Grass & Broadleaf Herbicides)			
napropamide DEVRINOL DF (50 DF)	2.25 to 4.5 kg/ha 4.5 to 9 kg/ha	 1.8 to 3.6 kg/ac	Treat at planting time, or soon after planting before weed seedlings appear. Use lower rate on sandy soils and the higher rate on clay soils. Incorporation by irrigation or rainfall is essential.
1st Year Crown, Established (Postemergence Grass Herbicide)			
fluazifop-p-butyl FUSILADE II (125g/L)	0.075 to 0.25 kg/ha 0.6 to 2 L/ha	 0.24 to 0.8 L/ac	Apply at 0.6 L/ha (0.24 L/ac) at 2-5 leaf stage of annual grasses. Apply at 0.8 L/ha (0.32 L/ac) at 2-5 leaf stage of volunteer wheat and barley. Apply at 1 to 2 L/ha (0.4-0.8 L/ac) at 3-5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. Inter-row cultivation should not occur until 5 days after application.
2nd Year and Established Asparagus (Grass and Broadleaf Herbicides)			
diuron KARMEX (80 DF)	1.75 to 2.25 kg/ha 2.19 to 2.81 kg/ha	 0.88 to 1.12 kg/ac	Disk before any shoots appear in the spring on established plantings. This may be followed by one of the following herbicides. Linuron, diuron, metribuzin, simazine or simazine plus napropamide should be applied immediately after the spring disking before weeds germinate in established asparagus. A second application may be made after the postharvest disking. CAUTION: The lower rates are recommended for lighter soils. Rates are given for overall sprays; reduce proportionately if only rows are sprayed. Extreme caution is needed if diuron or simazine is used in rotations where susceptible crops are to be grown one year after application.
glyphosate ROUNDUP (356g/L)	0.45 to 0.89 kg/ha 1.25 to 2.5 L/ha	 0.5 to 1 L/ac	For control of fall-seeded rye, apply in the spring before the spears emerge, but not closer than 7 days to harvest. Only 1 application per year may be used.

linuron	1.75 to 2.25 kg/ha		See notes for diuron (KARMEX) above.
LOROX DF (50 DF)	3.5 to 4.5 kg/ha	1.4 to 1.8 kg/ac	
AFOLAN F (480g/L)	3.64 to 4.69 L/ha	1.46 to 1.88 L/ac	
LINURON 480 (480g/L)	3.64 to 4.69 L/ha	1.46 to 1.88 L/ac	
metribuzin	1.1 to 2.25 kg/ha		See notes for diuron (KARMEX) above.
SENCOR 75 DF (75 WG)	1.46 to 3 kg/ha	0.58 to 1.2 kg/ac	
LEXONE DF (75 DF)	1.46 to 3 kg/ha	0.58 to 1.2 kg/ac	
simazine	1.1 to 2.2 kg/ha		Apply preemergent to established beds. Make only one application per season. DO NOT apply within 6 days of harvest.
PRINCEP NINE-T (90WG)	1.2 to 2.4 kg/ha	0.5 to 1 kg/ac	
plus napropamide	4.5 to 6.7 kg/ha		
DEVRINOL 50W (50 WP)	9 to 13.4 kg/ha	3.6 to 5.36 kg/ac	
simazine	2.2 to 3.4 kg/ha		Apply preemergence to crop, 7 days before first cutting. Use on established plantings of 3 years or older only.
PRINCEP NINE-T (90WG)	2.5 to 3.75 kg/ha	1 to 1.5 kg/ac	
SIMADEX (500g/L)	4.5 to 6.7 L/ha	1.8 to 2.68 L/ac	
SIMAZINE 480 (480g/L)	4.7 to 7 L/ha	1.88 to 2.8 L/ac	
terbacil	0.3 kg/ha		Apply 375 g/ha (150 g/ac) of SINBAR prior to spear emergence. Application may be made immediately after clean cutting. SINBAR must only be applied to established asparagus beds once throughout the entire growing season. Apply before annual weeds emerge, or to small, actively growing weeds (up to 5 cm tall or across). DO NOT use on soils containing less than 1% organic matter, or on areas where subsoil or roots are exposed. Crop injury may occur if SINBAR is used on plants that are weak or diseased, or lacking in vigor (slow growing). DO NOT harvest within 5 days of treatment. Treated areas may be replanted to asparagus the following year after application. DO NOT plant any other crop for 2 years. See label for further details.
SINBAR (80 WP)	0.375 kg/ha	0.15 kg/ac	
Before Spear Emergence or After Last Cutting (Soil Applied)			
trifluralin	1 to 2 kg/ha		Application should occur early enough in the spring to ensure that spears are not injured by the required incorporation (5-10 cm). Apply after last cutting of spears (post harvest disking) and incorporate as indicated on the label. Use only on established plantings of three years or older.
TREFLAN (480g/L)	2.08 to 4.16 L/ha	0.83 to 1.66 L/ac	
RIVAL DF (60 DF)	1.67 to 3.34 kg/ha	0.67 to 1.33 kg/ac	
BONANZA 400 (400g/L)	2.5 to 5 L/ha	1 to 2 L/ac	
Before Spear Emergence or After Last Cutting (Postemergent)			
paraquat	0.6 to 1.1 kg/ha		Apply in 300 to 1100 L/ha (120-440 L/ac) water. Paraquat should also be applied on weed seedlings before asparagus tips appear or after the last cutting. DO NOT apply to emerged spears which are to be used for human consumption. It is particularly effective for control of grass. Use the higher volume of water on dense weed growth.
GRAMOXONE (200g/L)	3 to 5.5 L/ha	1.2 to 2.2 L/ac	
During Harvest Immediately After Cutting			

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
2,4-D * 2,4-D (470g/L)	1.293 kg/ha 2.75 L/ha	1.1 L/ac	Apply in 50 to 200 L/ha (20-80 L/ac) water. May be applied early in the season just after a cutting. Consult product label for specific instructions for asparagus. Emerging spears may be twisted. Discard twisted spears. Later emerging spears will be normal. Spray immediately after a close harvest to avoid injury.
[illegible]			
2,4-D * 2,4-D (470g/L)	0.94 to 1.293 kg/ha 2 to 2.75 L/ha	0.8 to 1.1 L/ac	Apply in 50 to 200 L/ha (20-80 L/ac) water. Apply 3 weeks after the post cutting disking. Direct spray to avoid wetting the asparagus fern. Consult label for specific instructions for asparagus.
fenoxaprop-p-ethyl EXCEL SUPER (80.5 g/L)	0.054 kg/ha 0.67 L/ha	0.27 L/ac	Apply to asparagus only after the spears have been harvested. DO NOT treat spears prior to or during harvest. Apply when majority of annual grasses are in the 1 to 6 leaf stage or until volunteer corn is up to 25 cm tall. Second flush annual grasses will not be controlled if emergence occurs after application.
glufosinate ammonium IGNITE (150g/L)	0.405 to 0.75 kg/ha 2.7 to 5 L/ha	1.08 to 2 L/ac	Apply in 110-330 L/ha (44-132 L/ac) water. Spray on emerged weeds prior to emergence of the crop. Weeds which have not emerged will not be controlled. Ensure uniform coverage. See label for more detailed information.

Beets (Red)

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

[illegible]			
cycloate RO-NEET (720g/L)	3.42 to 4.5 kg/ha 4.75 to 6.25 L/ha	1.9 to 2.5 L/ac	Apply in 150 to 300 L/ha (60-120 L/ac) water. Use on mineral soils only. Cycloate should be applied to a dry soil surface before planting and incorporated. Use the lower rate on sandy soils. These treatments are usually not effective on highly organic soils.
[illegible]			
pyrazon PYRAMIN FL (430g/L)	3.54 to 4.4 kg/ha 8.25 to 10.25 L/ha	3.3 to 4.1 L/ac	Apply in 150 to 300 L/ha (60-120 L/ac) water. DO NOT use on soils less than 3% organic matter. Rainfall or irrigation is required for herbicidal activation.
[illegible]			
pyrazon PYRAMIN FL (430g/L) plus CITOWETT PLUS SUPER SPREADER STICKER	3.54 kg/ha 8.25 L/ha	3.3 L/ac	Apply in 300-400 L/ha (120-160 L/ac) water. The use of any other oils or surfactants may cause crop injury. DO NOT use ASSIST or MERGE. For best results, apply before third true leaf or broadleaf weeds.
[illegible]			

phenmedipham SPIN-AID (150g/L)	0.75 to 1 kg/ha 5 to 6.6 L/ha	 2 to 2.64 L/ac	DO NOT apply more than twice per season. Use a maximum of 28 L of water for each litre Spin-Aid. Spin-Aid may cause temporary growth retardation and/or chlorosis or tip burn on red beets. Beets usually resume normal growth within 10 days. Apply Spin-Aid when weeds are past the cotyledonary up to the 4 true leaf stage. Spin-Aid is selective in red beets past the 3 true leaf stage. Red Beets in the cotyledonary stage may be scorched. DO NOT spray while dew is present. Rainfall within 6 hours of spraying may reduce weed kill. Delay application until evening if days are hot (30°C or over) or rapid climatic change from cool, overcast days. DO NOT apply if beets are under stress.

Cabbage, Cauliflower, Broccoli, Brussels Sprouts

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

napropamide DEVRINOL DF (50 DF)	1.12 to 2.25 kg/ha 2.25 to 4.5 kg/ha	 0.9 to 1.8 kg/ac	Use the lower rate on light soils (coarse textured-sandy and sandy loam). One application per year as a preemergent or preplant incorporated treatment. DO NOT harvest within 60 days. Usual rotational crop restrictions apply. Apply to well worked soil that is dry enough to permit thorough incorporation to a depth of 2.5 to 5.0 cm. Incorporate the same day as applied. After harvest, soil should be worked (across rows if banded) to prevent injury to succeeding crops. Small grains seeded in the fall may be stunted but not otherwise affected. Use on transplanted cabbage, cauliflower, and broccoli only. Consult product labels for more information.
s-metolachlor DUAL MAGNUM (915g/L) or s-metolachlor/benoxacor DUAL II MAGNUM (915g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha	 0.5 to 0.7 L/ac 0.5 to 0.7 L/ac	Apply within 2 days of transplanting before weeds emerge. Use the higher rate for heavier weed pressure. Apply as a ground application only in 300 L water/ha. Use only one application per year. Do not incorporate, and do not use on seeded cole crops. Do not apply to soil with less than 1% or more than 10% organic matter. Use on transplanted cabbage, cauliflower and broccoli only.
trifluralin TREFLAN (480 g/L) RIVAL DF (60 DF) BONANZA 400 (400g/L)	0.6 to 1.1 kg/ha 1.25 to 2.3 L/ha 1 to 1.9 kg/ha 1.5 to 2.75 L/ha	 0.5 to 0.92 L/ac 0.4 to 0.76 kg/ac 0.6 to 1.1 L/ac	Direct seeded cabbage or cauliflower or transplants of cabbage, cauliflower, broccoli and Brussels sprouts. Incorporate after application.
fenoxaprop-p-ethyl EXCEL SUPER (80.5g/L)	0.054 kg/ha 0.67 L/ha	 0.27 L/ac	NOT REGISTERED FOR USE ON BRUSSELS SPROUTS. Apply when majority of annual grasses are in the 1 to 6 leaf stage or until volunteer corn is up to 25 cm tall. Second flush annual grasses will not be controlled if emergence occurs after application.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
fluazifop-p-butyl FUSILADE II (125g/L)	0.1 to 0.25 kg/ha 0.8 to 2 L/ha	 0.32 to 0.8 L/ac	Apply at 0.8 L/ha (0.32 L/ac) at 2-5 leaf stage of annual grasses, volunteer wheat and barley. Apply at 1 to 2 L/ha (0.4-0.8 L/ac) at 3-5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage, fragmenting quackgrass rhizome improves control. Inter-row cultivation should not occur until 5 days after application. Make one application per season.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 1 L/ha	 0.13 to 0.19 L/ac 0.4 L/ac	Broccoli, cabbage and cauliflower are tolerant to sethoxydim at any stage of growth. Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after treatment. Apply using 110 to 200 L/ha (44-80 L/ac) water. DO NOT use on Brussels sprouts.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 1 to 2 L/ha	 0.45 L/ac 0.4 to 0.8 L/ac	Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass in 110 to 200 L/ha (44-80 L/ac) water. Use MERGE at a rate of 1 % v/v. Crop competition and inter-row cultivation 7 to 14 days after application will provide quackgrass control for 6 to 8 weeks. Use on cabbage and cauliflower only.
clopyralid LONTREL 360 (360g/L)	0.20 kg/ha 0.56 L/ha	 0.2 L/ac	Apply post transplant as a ground application only, in 300 L water/ha. Use only one application per year, no closer than 30 days to harvest. Use on transplanted cabbage, cauliflower and broccoli only.
pyridate LENTAGRAN (45 WP)	0.9 kg/ha 2 kg/ha	 0.8 kg/ac	May be applied following a ppi application of trifluralin. Use on direct-seeded or transplanted cabbage only. Apply when crop is well established. See label for further details.

Carrots

PREPLANT - See under **PREPLANT - SITE PREPARATION** for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

trifluralin TREFLAN EC (480g/L) RIVAL DF (60 DF) BONANZA 400 (400g/L) followed by linuron LOROX DF (50 DF) or linuron AFOLAN F (480g/L) LINURON 480 (480g/L)	0.6 to 1.1 kg/ha 1.25 to 2.4 L/ha 1 to 1.9 kg/ha 1.5 to 2.75 L/ha 0.55 to 1.625 kg/ha 1.1 to 3.25 kg/ha 0.624 to 1.2 kg/ha 1.3 to 2.5 L/ha 1.1 to 2.25 L/ha	 0.5 to 0.96 L/ac 0.4 to 0.76 kg/ac 0.6 to 1.1 L/ac 0.44 to 1.3 kg/ac 0.52 to 1 L/ac 0.44 to 0.9 L/ac	A preplanting application of trifluralin on mineral soils can control most weeds until the carrots have developed to the stage at which the linuron postemergence treatment can be used.

linuron	0.55 to 1.125 kg/ha		These treatments must be at least 2 weeks apart. DO NOT apply more than 2 applications per season.
LOROX DF (50 DF)	1.1 to 2.25 kg/ha	0.44 to 0.9 kg/ac	
followed by linuron	1.125 to 2.25 kg/ha		
LOROX DF (50 DF)	2.25 to 4.5 kg/ha	0.9 to 1.8 kg/ac	
OR			
linuron	0.624 to 0.912 kg/ha		
AFOLAN F (480g/L)	1.3 to 1.9 L/ha	0.52 to 0.76 L/ac	
followed by linuron	0.912 to 1.2 kg/ha		
AFOLAN F (480g/L)	1.9 to 2.5 L/ha	0.76 to 1 L/ac	
OR			
linuron	0.53 to 1.08 kg/ha		
LINURON 480 (480g/L)	1.1 to 2.25 L/ha	0.44 to 0.9 L/ac	
followed by linuron	1.08 to 2.165 kg/ha		
LINURON 480 (480g/L)	2.25 to 4.5 L/ha	0.9 to 1.8 L/ac	
prometryne	1.8 to 3.4 kg/ha		A combination procedure which has been successful on muck soils is to use the preemergence prometryne treatment followed by a postemergence linuron treatment as required.
GESAGARD 480 SC (480g/L)	3.75 to 7.08 L/ha	1.5 to 2.83 L/ac	
followed by linuron	0.55 to 1.625 kg/ha		
LOROX DF (50 DF)	1.1 to 3.25 kg/ha	0.44 to 1.3 kg/ac	
or linuron	0.624 to 1.2 kg/ha		
AFOLAN F (480g/L)	1.3 to 2.5 L/ha	0.52 to 1 L/ac	
[redacted]			
linuron	0.55 to 1.625 kg/ha		Apply in 200 to 350 L/ha (80-140 L/ac) water. Apply as a band or broadcast spray after planting but before carrots emerge. Use the lower rate on sandy soils. Carrots are very sensitive to this treatment at the time of emergence and severe injury can occur at this time if there is a heavy rain or if the area is irrigated.
LOROX DF (50 DF)	1.1 to 3.25 kg/ha	0.44 to 1.3 kg/ac	
or linuron	0.624 to 1.2 kg/ha		
AFOLAN F (480g/L)	1.3 to 2.5 L/ha	0.52 to 1 L/ac	
prometryne	1.8 to 3.4 kg/ha		Apply in 200 to 1000 L/ha (80-400 L/ac) water. Use the lower rate on sandy soils and the higher rate on muck soils. Prometryne should also be applied soon after seeding. DO NOT use at or near time of emergence. IT IS NOT REGISTERED FOR POSTEMERGENCE USE.
GESAGARD 480 SC (480g/L)	3.75 to 7.08 L/ha	1.5 to 2.83 L/ac	
trifluralin	0.6 to 1.1 kg/ha		Incorporate after application.
TREFLAN EC (480g/L)	1.25 to 2.4 L/ha	0.5 to 0.96 L/ac	
RIVAL DF (60 DF)	1 to 1.9 kg/ha	0.4 to 0.76 kg/ac	
BONANZA 400 (400g/L)	1.5 to 2.75 L/ha	0.6 to 1.1 L/ac	
[redacted]			
diclofop-methyl	1 kg/ha		Diclofop-methyl should be applied postemergence to annual grasses in the 1 to 4 leaf stage (optimum control at 2 to 3 leaf stage, approximately 10 to 16 days after emergence). DO NOT apply if rain is expected within one hour after application.
HOE-GRASS 284 (284g/L)	3.5 L/ha	1.4 L/ac	

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
fenoxaprop-p-ethyl EXCEL SUPER (80.5g/L)	0.054 kg/ha 0.67 L/ha	 0.27 L/ac	Apply when majority of annual grasses are in the 1 to 6 leaf stage or until volunteer corn is up to 25 cm tall. Second flush annual grasses will not be controlled if emergence occurs after application. DO NOT apply if rain is expected within one hour after application.
fluazifop-p-butyl FUSILADE II (125g/L)	0.075 to 0.25 kg/ha 0.6 to 2 L/ha	 0.24 to 0.8 L/ac	Apply when crop is 10 cm in height or less. Apply at 0.6-1 L/ha (0.24-0.4 L/ac) at 2-5 leaf stage of annual grasses. Apply at 0.8 L/ha (0.32 L/ac) at 2-5 leaf stage of volunteer wheat and barley. Apply at 1-2 L/ha (0.4-0.8 L/ac) at 3-5 leaf stage of quackgrass and wire stemmed muhly. Thorough preplant tillage fragmenting quackgrass rhizomes improves control. Inter-row cultivation should not occur until 5 days after application. Apply other postemergence herbicides separately at least 3 days after FUSILADE II.
Postemergent Grass and Broadleaf Herbicides			
linuron LOROX DF (50 DF) or linuron AFOLAN F (480g/L)	1.125 to 2.25 kg/ha 2.25 to 4.5 kg/ha 0.912 to 2.256 kg/ha 1.9 to 4.69 L/ha	 0.9 to 1.8 kg/ac 0.76 to 1.88 L/ac	Spray when crop has 2 or more fully developed leaves (8-15 cm tall). Carrot leaves will become yellow or light green, but they will soon regain their normal colour. Injury may occur when spraying is done during hot, dry weather (>32°C) or when crop is under stress. Apply before annual grasses are 5 cm high and before broadleaf weeds are 15 cm high.
mineral oil (herbicidal) overall spray rows only undiluted	 600 to 800 L/ha 300 to 400 L/ha	 240 to 320 L/ac 120 to 160 L/ac	Apply the selective herbicidal oil as soon as true leaves develop and before roots of carrots are thicker than a pencil. Later treatments may produce an oil flavor. Weeds should be less than 10 cm high. Ragweed, wormwood, and wild carrot are not controlled.
Celery			
PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.			
Postemergent Grass and Broadleaf Herbicides			
linuron AFOLAN F (480g/L)	0.9 to 2.25 kg/ha 1.87 to 4.68 L/ha	 0.75 to 1.87 L/ac	Apply in 150 to 300 L/ha (60-120 L/ac) water in the transplanted crop. Linuron should be applied 8 to 10 days after transplanting. Some yellowing of the leaves may be noticed but this will be temporary.
mineral oil (herbicidal) overall spray rows only	 600 to 800 L/ha 300 to 400 L/ha	 240 to 320 L/ac 120 to 160 L/ac	Herbicidal oil should be used only on outdoor seedbed and only if the soil is moist. Apply as the true leaves develop on the celery, before weeds are 10 cm high.
prometryne GESAGARD 480 SC (480g/L)	1.8 to 2.2 kg/ha 3.75 to 4.58 L/ha	 1.5 to 1.83 L/ac	Apply in 200 to 1000 L/ha (80-400 L/ac) water in the transplanted crop. DO NOT use on direct seeded crop. Prometryne applications should be delayed 21 days after transplanting crop until the celery plants are established.
Cucumber			
PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.			
PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.			
Preplant(Stale Seedbed Techniques)			

glyphosate ROUNDUP (356g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L) plus surfactant AGRAL 90, AG-SURF, ENHANCE	0.267 to 1.246 kg/ha 0.75 to 3.5 L/ha 0.248 to 1.155 kg/ha 0.75 to 3.5 L/ha 0.35 L/ha	 0.3 to 1.4 L/ac 0.3 to 1.4 L/ac 0.14 L/ac	Till and fertilize soil in early spring. Allow weeds to grow. Spray weeds just before seeding crop. Use low rate for small weeds (8 cm), medium rates for weeds 8 to 15 cm and higher rate for weeds over 15 cm tall. Apply recommended preemergence or postemergence herbicides to control new flushes of weeds or use mechanical means of control.
Soil Applied Grass Herbicides			
bensulide PREFAR (480g/L)	5.75 to 6.75 kg/ha 12 to 14 L/ha	 4.8 to 5.6 L/ac	Apply preplant incorporated on mineral soils only. Bensulide should be applied before planting and incorporated thoroughly into the soil to a depth of 2.5 to 5 cm.
Soil Applied Broadleaf Herbicides			
naptalam ALANAP (240g/L)	2.64 to 7.19 kg/ha 11 to 30 L/ha	 4.4 to 12 L/ac	Apply preemergent to weeds, following seeding of cucumber crop. ALANAP may also be applied as a postemergence spray about one month after the preemergence spray when the crop has emerged following a clean cultivation.
Soil Applied Grass and Broadleaf Herbicides			
bensulide PREFAR (480g/L) followed by naptalam ALANAP (240g/L)	4.56 to 6.75 kg/ha 9.5 to 14 L/ha 2.28 to 4.56 kg/ha 9.5 to 19 L/ha	 3.8 to 5.6 L/ac 3.8 to 7.7 L/ac	Bensulide should be applied before planting and incorporated thoroughly into the soil to a depth of 2.5 to 5 cm. DO NOT use on muck soils. Bensulide and naptalam may also be tank mixed and applied preplant incorporated. When tank mixed with naptalam, incorporation should be done to a depth of 2.5 cm or less. Use power-driven rotary cultivators or other equipment which will result in satisfactory incorporation. Use the lower rates on light, sandy soils.
Postemergent Grass Herbicides			
fluazifop-p-butyl FUSILADE II (125g/L)	0.1 to 0.25 kg/ha 0.8 to 2 L/ha	 0.32 to 0.8 L/ac	Apply at 0.8 L/ha (0.32 L/ac) at 2-5 leaf stage of annual grasses, volunteer wheat and barley. Apply at 1 to 2 L/ha (0.4-0.8 L/ac) at 3-5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage, fragmenting quackgrass rhizome improves control. Inter-row cultivation should not occur until 5 days after application. Make one application per season.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 1 L/ha	 0.13 to 0.19 L/ac 0.4 L/ac	Cucumbers are tolerant to sethoxydim at any stage of growth. Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after treatment. Apply using 110 to 200 L/ha (44-80 L/ac) water.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 1 to 2 L/ha	 0.45 L/ac 0.4 to 0.8 L/ac	Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass in 110 to 200 L/ha (44-80 L/ac) water. Use MERGE at a rate of 1 % v/v. Crop competition and inter-row cultivation 7 to 14 days after application will provide quackgrass control for 6 to 8 weeks.

Garlic

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.			
PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.			
napropamide DEVRINOL DF (50 DF)	1.12 to 2.25 kg/ha 2.25 to 4.5 kg/ha	 0.9 to 1.8 kg/ac	Use the lower rate on light soils (coarse textured-sandy and sandy loam). One preemergent application per year only. Apply prior to crop and weed emergence. DO NOT harvest within 60 days. Usual rotational crop restrictions apply. After harvest, soil should be worked (across rows if banded) to prevent injury to succeeding crops. Small grains seeded in the fall may be stunted but not otherwise affected. Consult product label for more information.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 1 L/ha	 0.13 to 0.19 L/ac 0.4 L/ac	Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while the crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after treatment. Apply using 110 L/ha (44 L/ac) water.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 1 to 2 L/ha	 0.45 L/ac 0.4 to 0.8 L/ac	Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass. Apply in 110 to 200 L/ha (44-80 L/ac) water. Use MERGE at a rate of 1% v/v. Crop competition inter-row cultivation 7 to 14 days after application will provide quackgrass control for 6 to 8 weeks.
bromoxynil PARDNER (280g/L)	0.28 kg/ha 1 L/ha	 0.4 L/ac	Controls most annual broadleaf weeds, including triazine resistant species at the 1 to 4 leaf stage. Bromoxynil is a contact herbicide and is non-volatile. Consult product label for list of weeds controlled.
Herbs			
PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.			
PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.			
PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.			
napropamide DEVRINOL DF (50 DF)	0.56 to 1.12 kg/ha 1.12 to 2.24 kg/ha	 0.45 to 0.9 kg/ac	Apply in 200-900 L/ha (80-360 L/ac) water. One application per year as a preemergence or preplant incorporated treatment. Usual rotational crop restrictions apply. To avoid injury to crops not specified on the complete label, do not plant until 12 months after the last application. CAUTION: Use of DEVRINOL 50 DF at the high label rates of application may result in temporary crop stunting or retardation. However, crops will outgrow the injury and yield is unaffected. (Consult label). USE ON BASIL ONLY.

Postemergent Grass Herbicides

sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha	0.13 to 0.19 L/ac	Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after treatment. Apply using 110-200 L/ha (44-80 L/ac) water volume. (Consult Label). USE ON SPEARMINT AND PEPPERMINT ONLY.
MERGE	1 L/ha	0.4 L/ac	

Leeks

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Postemergent Grass and Broadleaf Herbicides

prometryne GESAGARD 480 SC (480g/L)	1.8 kg/ha 3.75 L/ha	1.5 L/ac	Apply 2 applications 10 days apart, before weeds are 5 cm high. Make the first application to well-established transplanted leeks that have produced one new fully expanded leaf. Can be used on either muck or mineral soils. DO NOT apply more than 2 applications a year. Temporary injury can occur to the lower leaves in some cultivars of leek.

Lettuce

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Soil-Incorporated Grass and Broadleaf Herbicides

chlorpropham CIPC EC (480g/L)	4.5 to 6.75 kg/ha 9.36 to 14 L/ha	3.74 to 5.6 L/ac	When overhead irrigation is used at seeding time, delay chlorpropham application until after first irrigation but before crop emergence. Use lower rates in cool, wet weather to avoid injury and delay in emergence. Use lower rates in mineral soils.
propyzamide KERB (50 WP)	2.2 to 4.5 kg/ha 4.4 to 9 kg/ha	1.76 to 3.6 kg/ac	Use only once per year. Apply 7-10 days post-transplant or ppi, preemergence or postemergence on seeded lettuce (55 days to harvest). Not recommended for muck soils.

Muskmelon, Watermelon, Squash and Pumpkin

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Soil-Applied Broadleaf Herbicides

naptalam ALANAP (240g/L)	2.638 to 7.194 kg/ha 11 to 30 L/ha	4.4 to 12 L/ac	DO NOT USE ON BUTTERNUT SQUASH; some injury may occur to Table Queen squash. Apply prior to crop and weed emergence. ALANAP may be applied to melons (not squash or pumpkins) as a postemergence spray about 1 month after the preemergence spray when the crop has emerged but before the weeds are up.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
napropamide DEVRINOL DF (50 DF)	1.12 to 2.25 kg/ha 2.24 to 4.5 kg/ha	 0.9 to 1.8 kg/ac	Apply in 200-900 L/ha (80-360 L/ac) water. Make only one preemergence application per season. Use the lower rate on light soils (coarse textured, sandy or sandy loam). Shepherd's-purse and lady's thumb may escape treatment at this rate. DEVRINOL requires rainfall or irrigation with sufficient water to wet the soil to a depth of 5 to 10 cm soon after application for adequate weed control. Application should be timed to take advantage of rainfall if irrigation is not available. After harvest, soil should be worked (across rows if banded) to prevent injury to succeeding crops. Small grains seeded in the fall may be stunted but not otherwise affected. Consult product labels for more information. USE ON DIRECT SEEDED PUMPKIN AND SQUASH ONLY.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 1 to 2 L/ha	 0.13 to 0.19 L/ac 0.4 to 0.8 L/ac	Pumpkins and Squash ONLY - Apply the lower rate for actively growing annual grasses in the 1 to 6-leaf stage. DO NOT apply closer than 30 days to harvest.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 1 to 2 L/ha	 0.45 L/ac 0.4 to 0.8 L/ac	Pumpkins and Squash only. Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass in 110 to 200 L/ha (44-80 L/ac) water. Use MERGE at a rate of 1% v/v. Crop competition and inter-row cultivation 7 to 14 days after application will provide quackgrass control for 6 to 8 weeks.

Onions

Most experience with herbicides below has been with the seeded crop. Experience with sets and limited experience with Spanish onions have been satisfactory. On green bunching onions, the granular formulations (applied when the leaves are dry) are recommended to avoid leaf injury.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

chlorpropham CIPC EC (480g/L) CIPC GR (20 Gr)	4.5 to 9 kg/ha 9.36 to 18.72 L/ha 22.5 to 45 kg/ha	 3.74 to 7.49 L/ac 9 to 18 kg/ac	Apply these rates on muck soils. Use 9.36-14 L/ha (3.74-5.6 L/ac) on mineral soils. Preemergence or directed postemergence. Chlorpropham is most effective when the weed seeds are germinating. Under cool, moist conditions reduction in stand with decrease in yields has occurred. Direct the postemergence spray to avoid onion leaves. Excellent control of purslane may be obtained. Groundsel, lamb's-quarters and ragweed are somewhat resistant. DO NOT use this chemical on bunching onions.
clethodim SELECT (240g/L)	0.09 kg/ha 0.38 L/ha	 0.15 L/ac	For control of annual blue grass, other annual grasses and quackgrass. Apply when the crop is in the 1-4 leaf stage and the weeds are in the 2-6 leaf stage.

diclofop-methyl HOE-GRASS 284 (284g/L)	1 kg/ha 3.5 L/ha	 1.4 L/ac	Diclofop-methyl should be applied postemergence to annual grasses in the 1 to 4 leaf stage (optimum control at 2 to 3 leaf stage, approximately 10 to 16 days after emergence). DO NOT apply if rain is expected within one hour after application.
fenoxaprop-p-ethyl EXCEL SUPER (80.5g/L)	0.054 kg/ha 0.67 L/ha	 0.27 L/ac	Apply when majority of annual grasses are in the 1 to 6 leaf stage or until volunteer corn is up to 25 cm tall. Second flush annual grasses will not be controlled if emergence occurs after application. DO NOT apply if rain is expected within one hour after application.
fluazifop-p-butyl FUSILADE II (125g/L)	0.075 to 0.125 kg/ha 0.6 to 1 L/ha	 0.24 to 0.4 L/ac	Volunteer cereals will be controlled with 0.8 L/ha (0.32 L/ac). A repeat application may be made to control annual grasses, if required, but not less than 42 days before harvest. Apply in a maximum volume of 300 L/ha (120 L/ac). See "Notes on Chemicals" section.
fluazifop-p-butyl FUSILADE II (125g/L)	0.125 to 0.25 kg/ha 1 to 2 L/ha	 0.4 to 0.8 L/ac	Use the higher rate when quackgrass is present. Preplant tillage to break up rhizomes will improve control of quackgrass. Deep plowing may hinder the break up of rhizomes. Apply in a maximum volume of 300 L/ha (120 L/ac). Only one application of this rate is permitted per season and it should be no less than 60 days to harvest. See "Notes on Chemicals" section.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 1 L/ha	 0.13 to 0.19 L/ac 0.4 L/ac	Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while the crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after treatment. Apply using 110 L/ha (44 L/ac) water.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE or oil concentrate ASSIST	0.5 kg/ha 1.1 L/ha 1 to 2 L/ha 4 L/ha	 0.45 L/ac 0.4 to 0.8 L/ac 1.6 L/ac	Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass. Apply in 110-200 L/ha (44-80 L/ac) water. Use MERGE at a rate of 1% v/v. Crop competition inter-row cultivation 7 to 14 days after application will provide quackgrass control for 6 to 8 weeks.
Postemergent Broadleaf Herbicides			
oxyfluorfen GOAL 2XL (240g/L)	0.12 kg/ha 0.5 L/ha	 0.2 L/ac	Apply in minimum of 500 L/ha (200 L/ac) water at the 2 fully developed leaf stage of onions. DO NOT apply in excess of 2.0 L/ha (0.8 L/ac) per year. PERMITS are required from the Ontario Ministry of the Environment under the Pesticides Act for the use of GOAL 2XL (oxyfluorfen). Permit applications should be made to the Ministry of Environment Pesticide Control Field Officers.
Preemergent Grass and Broadleaf Herbicides			
pendimethalin PROWL 400 (400g/L)	1 to 1.5 kg/ha 2.5 to 3.75 L/ha	 1 to 1.5 L/ac	Mineral soils: Pendimethalin can be applied at the 2 leaf stage and 6 leaf stage of crop development. Both applications are required for season long control. Pendimethalin controls weeds as they emerge. Destroy existing weeds prior to application. For use on direct seeded dry bulb onions grown in mineral soils.
pendimethalin PROWL 400 (400g/L)	3 kg/ha 7.5 L/ha	 3 L/ac	Muck soils: Pendimethalin can be applied at the loop and/or 2 leaf stage of crop development. Both applications are required for season long control. Pendimethalin controls weeds as they emerge. Destroy existing weeds prior to application. For use on direct seeded dry bulb onions grown in muck soil only.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
Parsnips			
PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.			
PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.			
linuron AFOLAN F (480g/L) followed by linuron AFOLAN F (480g/L)	0.624 to 0.912 kg/ha 1.3 to 1.9 L/ha 0.912 to 1.2 kg/ha 1.9 to 2.5 L/ha	 0.5 to 0.75 L/ac 0.75 to 1 L/ac	These treatments must be at least 2 weeks apart. DO NOT apply more than these two applications per season.
chlorpropham CIPC EC (480g/L) CIPC (20 Gr)	4.5 to 9 kg/ha 9.36 to 18.72 L/ha 22.5 to 45 kg/ha	 3.75 to 7.5 L/ac 9 to 18 kg/ac	Chlorpropham should be used at the lower rate on mineral soils and at the higher rate on muck. Apply at time of seeding or until shortly before emergence of crop and weeds.
linuron AFOLAN F (480g/L)	0.624 to 1.2 kg/ha 1.3 to 2.5 L/ha	 0.5 to 1 L/ac	Apply in 200-400 L/ha (80-160 L/ac) water. Linuron should be applied soon after seeding. Use lower rate on sandy soil. Heavy rains or irrigation at time of emergence may cause injury.
linuron AFOLAN F (480g/L)	0.912 to 2.256 kg/ha 1.9 to 4.7 L/ha	 0.76 to 1.88 L/ac	Apply after parsnips are 8 cm tall. On sandy soils, do not use more than 2.5 L/ha (1 L/ac). Applications when the temperature is high, may cause injury especially at the higher rate.
mineral oil (herbicidal) overall spray row only undiluted	 600 to 800 L/ha 300 to 400 L/ha	 240 to 320 L/ac 120 to 160 L/ac	Herbicidal oil should be applied as soon as true leaves develop and before roots of parsnips are thicker than a pencil. Later treatments may produce an oil flavor. Weeds should be less than 10 cm high.
Peas			
PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.			
PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.			
PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.			
s-metolachlor DUAL MAGNUM (915g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha	 0.5 to 0.7 L/ac	Make one application per season before weeds emerge. Apply in 150-250 L/ha (60-100 L/ac) water. Apply by ground application equipment only. Use higher rate for heavier weed problems.

triallate AVADEX BW (400g/L)	1.7 kg/ha 4.25 L/ha	 1.7 L/ac	Apply and incorporate before planting in 150-200 L/ha (60-80 L/ac) water, for dry peas only.
prometryne GESAGARD 480 (480 g/L)	1.8 to 2.2 kg/ha 3.75 to 4.58 L/ha	 1.5 to 1.83 L/ac	Apply before weeds emerge in 200-1000 L/ha (80-400 L/ac) water. Will control Eastern Black Nightshade.
imazethapyr PURSUIT (240g/L)	0.075 kg/ha 0.312 L/ha	 0.125 L/ac	Only apply once per year as a preplant incorporated or preemergence treatment. Apply in 200 L/ha (80 L/ac) water. Allow a preharvest interval of 60 days.
trifluralin TREFLAN(480g/L) RIVAL DF (60 DF) BONANZA 400 (400g/L)	0.6 to 0.8 kg/ha 1.25 to 1.66 L/ha 1 to 1.3 kg/ha 1.5 to 2 L/ha	 0.5 to 0.66 L/ac 0.4 to 0.52 kg/ac 0.6 to 0.8 L/ac	Incorporate after application.
diclofop-methyl HOE-GRASS 284 (284g/L)	0.7 kg/ha 2.5 L/ha	 1 L/ac	For optimum weed control apply diclofop-methyl when the majority of the grass weeds are in the 2 to 3 leaf stage. Spray tips angled forward at 45° will give better coverage. DO NOT apply if rain is expected within one hour after application.
fenoxaprop-p-ethyl EXCEL SUPER (80.5g/L)	0.054 kg/ha 0.67 L/ha	 0.27 L/ac	Apply when majority of annual grasses are in the 1 to 6 leaf stage or until volunteer corn is up to 25 cm tall. Second flush annual grasses will not be controlled if emergence occurred after application. DO NOT graze treated fields prior to harvest.
sethoxydim POAST ULTRA (450g/L) plus oil concentrate ASSIST or surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha 1 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac 0.4 L/ac	Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while the crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after treatment. Apply using 110-200 L/ha (44-80 L/ac) water.
sethoxydim POAST ULTRA (450g/L) plus oil concentrate ASSIST or surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 4 L/ha 1 to 2 L/ha	 0.45 L/ac 1.6 L/ac 0.4 to 0.8 L/ac	Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1-3 leaf stage of actively growing quackgrass. Apply in 110-200 L/ha (44-80 L/ac) water. Use MERGE at a rate of 1% v/v. Crop competition and inter-row cultivation 7 to 14 days after application will provide quackgrass control for 6 to 8 weeks.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
bentazon BASAGRAN (480g/L) plus surfactant CITOWETT PLUS or SUPER SPREADER STICKER or oil concentrate ASSIST	0.84 to 1.08 kg/ha 1.75 to 2.25 L/ha 2.5 L/1000L water 1.25 to 2.5 L/1000L 1 to 2 L/ha	 0.7 to 0.9 L/ac 2.5 L/1000L water 1.25 to 2.5 L/1000L 0.4 to 0.8 L/ac	Apply in 100-400 L/ha (40-160 L/ac) water postemergence after the peas have 3 pairs of leaves. Top growth of nutsedge and Canada thistle are controlled and field bindweed may be suppressed by 2 applications of 1.75 L/ha (0.7 L/ac); 10 days apart may be required. Under hot, humid conditions, reduce ASSIST oil concentrate to 1 L/ha (0.4 L/ac).
MCPA MCPA SODIUM 300 (300g/L) or MCPA MCPA AMINE (500g/L)	0.38 kg/ha 1.25 L/ha 0.25 kg/ha 0.5 L/ha	 0.5 L/ac 0.2 L/ac	Apply in 100 to 200 L/ha (40-80 L/ac) water. Avoid conditions prone to spray drift; high temperatures, high humidity, windy.
MCPB/MCPA TROPOTOX PLUS (400g/L) CLOVITOX PLUS (400 g/L)	1.1 to 1.7 kg/ha 2.75 to 4.25 L/ha 2.75 to 4.25 L/ha	 1.1 to 1.7 L/ac 1.1 to 1.7 L/ac	Apply in 150 to 200 L/ha (60-80 L/ac) water when the peas have 3 to 6 expanded leaves. DO NOT apply over 27 C, or under drought conditions.

Peppers

All treatments should be applied in 150 to 300 L/ha (60-120 L/ac) water.

Discussion of cultural methods can be found in the tomato section.

Weed control in the pepper crop is accomplished best by combining chemical and cultural methods.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

napropamide DEVRINOL DF (50 DF)	1.12 to 2.25 kg/ha 2.25 to 4.5 kg/ha	 0.9 to 1.8 kg/ac	Apply to well worked soil that is dry enough to permit thorough incorporation to a depth of 2.5 to 5.0 cm. Incorporate day of application to avoid breakdown by sunlight. Use only one application per season. Damage to subsequent cover crops can be reduced by tillage across the rows after harvest.
trifluralin TREFLAN (480g/L) RIVAL DF (60 DF) BONANZA 400 (400g/L)	0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1 to 1.9 kg/ha 1.5 to 2.75 L/ha	 0.5 to 0.96 L/ac 0.4 to 0.76 kg/ac 0.6 to 1.1 L/ac	Incorporate twice in cross directions using a tandem disc (7-10 km/hr) or vibrating tine cultivator (10-13 km/hr) set to work 8-10 cm deep. The first incorporation should be done as soon as possible after application but may be delayed up to 8 to 24 hours. (see label). The second incorporation is recommended anytime before planting. See "Notes on Chemicals" section for further details. If shallow cultivation is to be used to control additional broadleaf weeds, cultivation should start when the weeds have reached the 3 to 4 leaf stage.

Potatoes

A combination of chemical weed control with cultivation provides the best weed management system. Cultivation prior to potato emergence using various kinds of cultivation equipment (light harrows, finger weeders, hillers, etc.) will control the early flush of weeds. Root pruning of the crop should be minimized. If the crop is hilled after application of herbicides, it must be realized that areas of untreated soil will surface where another flush of weeds may result.

POTATO VINE KILLING - For information on products and rates of application of vine killing, consult your Horticultural Crop Advisor and follow the product label.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Soil Applied Grass Herbicides			
EPTC EPTAM (800g/L)	3.4 to 6.8 kg/ha 4.25 to 8.5 L/ha	 1.7 to 3.4 L/ac	Apply EPTC to a dry soil surface before planting and incorporate immediately. When applied under wet soil conditions weed control is poor. Use 2.2 to 3.4 L/ac rates for heavy weed infestations and nutsedge control. EPTAM can also be incorporated immediately at next to the last or last cultivation. This treatment may be of value if an earlier treatment has failed or if late germinating grasses are a problem. Use at 1.7 to 2.2 L/ac.
s-metolachlor DUAL MAGNUM (915g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha	 0.5 to 0.7 L/ac	DO NOT use s-metolachlor on the variety Superior, or on sandy or coarse textured soils low in organic matter. DO NOT apply DUAL MAGNUM at ground crack or if potatoes have emerged. Incorporate for nutsedge control.
Soil Applied Broadleaf Herbicides			
linuron LOROX DF (50 DF) AFOLAN F (480g/L) LINURON 480 (480g/L)	1.1 to 2.25 kg/ha 2.2 to 4.5 kg/ha 2.3 to 4.7 L/ha 2.3 to 4.7 L/ha	 0.88 to 1.8 kg/ac 0.92 to 1.88 L/ac 0.92 to 1.88 L/ac	Linuron can be applied immediately after hilling but the potato tops must be covered with soil or the potato plants will be injured. Use the lower rate on light sandy soils and the higher rate on muck or clay soils.
metobromuron PATORAN FL (400g/L)	1 to 3.4 kg/ha 2.5 to 8.5 L/ha	 1 to 3.4 L/ac	Metobromuron may be applied immediately after planting or hilling provided the tops are covered with soil during application. Application may be made when weeds have emerged provided they do not exceed 2.5 cm and tops are not exposed. Use the lower rate on light sandy soil and the higher rates on clay and muck soils. PATORAN FL (400 g/L) at the 2.5 L/ha (1 L/ac) rate may allow certain annual weeds to escape. Inter-row cultivation may be necessary for full season control.
metribuzin SENCOR 500 F (500g/L) or metribuzin LEXONE DF (75 DF)	0.6 to 1.1 kg/ha 1.2 to 2.2 L/ha 0.481 to 1.053 kg/ha 0.64 to 1.4 kg/ha	 0.48 to 0.88 L/ac 0.25 to 0.56 kg/ac	Apply after hilling before emergence of crop or weeds. DO NOT USE ON MUCK SOILS. Use the lower rate on sandy soil. DO NOT use on Belleisle, Tobique, or red skinned varieties. Metribuzin may be applied as pre/post split application provided the maximum total application rate does NOT exceed 1.12 kg active/ha. DO NOT use metribuzin postemergence on red skinned varieties.
metribuzin SENCOR 75 DF (75 WG) plus linuron LINURON 480 (480g/L)	0.63 to 0.825 kg/ha 0.84 to 1.1 kg/ha 0.72 to 1.728 kg/ha 1.5 to 3.59 L/ha	 0.34 to 0.44 kg/ac 0.6 to 1.44 L/ac	Apply after hilling and before emergence of the crop. Emerged weeds should not be taller than 4 cm. DO NOT use on muck soils. Use a lower rate on sandy soil. Use a higher rate on late potatoes for season long control. DO NOT use on Belleisle, Tobique, or red skinned varieties.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
monolinuron AFESIN (200g/L)	1.1 to 2.2 kg/ha 5.5 to 11 L/ha	 2.2 to 4.4 L/ac	Monolinuron can be applied immediately after hilling but all the potato tops must be covered with soil or the crop will be injured. Use the lower rate on soils low in organic matter and the higher rate on clay or soils high in organic matter.
EPTC EPTAM (800g/L) plus metribuzin SENCOR 500 F (500g/L) or metribuzin LEXONE DF (75 DF)	3.4 to 4.4 kg/ha 4.25 to 5.5 L/ha 0.55 to 0.875 kg/ha 1.1 to 1.75 L/ha 0.624 to 0.902 kg/ha 0.83 to 1.2 kg/ha	 1.7 to 2.2 L/ac 0.44 to 0.7 L/ac 0.33 to 0.48 kg/ac	Apply as a tank mix in 220-330 L/ha (88-132 L/ac) water and incorporate immediately. DO NOT use on muck soils. DO NOT use on Belleisle or Tobique varieties. May be applied through the irrigation system.
glufosinate ammonium IGNITE (150g/L)	0.405 to 0.75 kg/ha 2.7 to 5 L/ha	 1.08 to 2 L/ac	Apply in 110-330 L/ha (44-132 L/ac) of water at no later than ground crack of the crop. Weeds which have not emerged will not be controlled. Ensure uniform coverage. See label for more detailed information.
glufosinate ammonium IGNITE (150g/L) plus metribuzin SENCOR 500 F (500g/L) LEXONE DF (75 DF)	0.405 to 0.75 kg/ha 2.7 to 5 L/ha 0.55 kg/ha 1.1 L/ha 0.75 kg/ha	 1.08 to 2 L/ac 0.44 L/ac 0.3 kg/ac	See comments for IGNITE applied alone. Residual control of annual weeds may be obtained when IGNITE is tank mixed with SENCOR 500 F or LEXONE DF. Consult respective labels prior to application for further information. DO NOT use metribuzin on muck soils or on Belleisle or Tobique varieties.
metribuzin SENCOR 75 DF (75 WG) plus linuron LINURON 480 (480g/L) plus metolachlor DUAL (960g/L)	0.525 to 0.75 kg/ha 0.7 to 1 kg/ha 0.912 to 1.344 kg/ha 1.9 to 2.8 L/ha 1.92 to 2.88 kg/ha 2 to 3 L/ha	 0.28 to 0.4 kg/ac 0.76 to 1.12 L/ac 0.8 to 1.2 L/ac	Apply after hilling and before emergence of the crop. Emerged weeds should not be taller than 4 cm. DO NOT use on muck soils, or on sandy or coarse texture soils low in organic matter. Use a lower rate of metribuzin on sandy soil. Use only on late potato varieties. DO NOT use on Belleisle, Tobique, Superior, or red skinned varieties.
paraquat GRAMOXONE (200g/L)	0.6 to 0.85 kg/ha 3 to 4.25 L/ha	 1.2 to 1.7 L/ac	Apply in 275-550 L/ha (150-220 L/ac) water to emerged weeds. Use on Netted Gem and Cherokee varieties before emergence. Apply on other varieties until 25 to 30% of the crop has emerged but none of the tops should be over 5 to 8 cm in height. Temporary yellowing on the tops will occur. DO NOT use on emerged potato plants in the evening, under cloudy conditions or when the plants are under moisture stress.
s-metolachlor DUAL MAGNUM (915g/L) plus linuron LOROX DF (50 DF) AFOLAN F (480g/L) LINURON 480 (480g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 0.88 to 1.12 kg/ha 1.75 to 2.25 kg/ha 1.8 to 2.3 L/ha 1.8 to 2.3 L/ha	 0.5 to 0.7 L/ac 0.7 to 0.9 kg/ac 0.72 to 0.92 L/ac 0.72 to 0.92 L/ac	See remarks for DUAL MAGNUM. For more information about linuron see the remarks for linuron. S-metolachlor as a tank mix should be applied before emergence of the crop and weeds after the first hilling.

s-metolachlor DUAL MAGNUM (915g/L) plus metobromuron PATORAN FL (400g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 1.168 to 1.68 kg/ha 2.92 to 4.2 L/ha	 0.5 to 0.7 L/ac 1.17 to 1.68 L/ac	S-metolachlor as a tank mix should be applied before emergence of the crop and weeds after the first hilling. See remarks for DUAL MAGNUM. Use the lower rates on sandy soil.
s-metolachlor DUAL MAGNUM (915g/L) plus metribuzin SENCOR 500 F (500g/L) or metribuzin LEXONE DF (75 DF)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 0.55 to 1.125 kg/ha 1.1 to 2.25 L/ha 0.624 to 0.902 kg/ha 0.83 to 1.2 kg/ha	 0.5 to 0.7 L/ac 0.44 to 0.9 L/ac 0.33 to 0.48 kg/ac	See remarks for DUAL MAGNUM. Apply as a preplant incorporated or preemergence treatment. The tankmix should not be used on the varieties SUPERIOR, BELLEISLE, TOBIQUE. DO NOT apply on sandy or on coarse textured soils low in organic matter or on muck soils. DO NOT apply at ground crack or if potatoes have emerged.
s-metolachlor DUAL MAGNUM (915g/L) plus monolinuron AFESIN (200g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 1.1 to 1.7 kg/ha 5.5 to 8.5 L/ha	 0.5 to 0.7 L/ac 2.2 to 3.4 L/ac	S-metolachlor as a tank mix should be applied before emergence of the crop and weeds after the first hilling. See remarks for DUAL MAGNUM.
Postemergence Grass Herbicides			
clethodim SELECT (240g/L) plus surfactant AMIGO	0.03 to 0.09 kg/ha 0.13 to 0.38 L/ha 0.5 to 1 % v/v	 0.05 to 0.15 L/ac 0.5 to 1 % v/v	Potatoes are tolerant at any growth stage. Apply when the annual grasses and volunteer cereals are in the 2 to 6 leaf stage. Apply to quackgrass in the 2 to 5 leaf stage. Use the higher rate for control of quackgrass. Add the surfactant AMIGO at 0.5-1% v/v.
diclofop-methyl HOE-GRASS 284 (284g/L)	1 kg/ha 3.5 L/ha	 1.4 L/ac	DO NOT USE IN TANK MIX WITH OTHER HERBICIDES. Apply when the majority of the grass weeds are in the 2 to 3 leaf stage. DO NOT apply if rain is expected within an hour of application. Other postemergence herbicides should be applied at least 4 days before or after diclofop-methyl applications.
fenoxaprop-p-ethyl EXCEL SUPER (80.5g/L)	0.054 kg/ha 0.67 L/ha	 0.27 L/ac	Apply when majority of annual grasses are in the 1 to 6 leaf stage or until volunteer corn is up to 25 cm tall. DO NOT apply if rainfall is expected within one hour after application. Second flush annual grasses will not be controlled if emergence occurs after application.
fluazifop-p-butyl FUSILADE II (125g/L)	0.075 to 0.125 kg/ha 0.6 to 1 L/ha	 0.24 to 0.4 L/ac	Apply to actively growing annual grasses at the 2 to 4 leaf stage for foxtails, and the 2 to 5 leaf stage for other. Best results are obtained when fluazifop-p-butyl is applied prior to tillering. Application beyond the 5 leaf stage will not provide control. Use the low rate for volunteer corn; the high rate for foxtails, wild oats, proso millet, and crabgrass; the median rate for other grasses. Fluazifop-p-butyl may be tank mixed with metribuzin for broad spectrum weed control apply at least 90 days before harvest.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Rhizomes of quackgrass should be thoroughly fragmented by tillage prior to application. Apply to actively growing plants that have 3 to 5 leaves. DO NOT cultivate for at least 5 days after application. Fluazifop-p-butyl may be tank mixed with metribuzin. Apply at least 90 days before harvest.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
sethoxydim POAST ULTRA (450g/L) plus oil concentrate ASSIST or surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha 1 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac 0.4 L/ac	Potatoes are tolerant to sethoxydim at any stage of growth. Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while the crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after treatment. Apply using 110-200 L/ha (44-80 L/ac) water. Use the higher rate for volunteer cereal control.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 1 to 2 L/ha	 0.45 L/ac 0.4 to 0.8 L/ac	Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass. Apply in 110-200 L/ha (44-80 L/ac) water. Use MERGE at a rate of 1% v/v. Crop competition and inter-row cultivation 7 to 14 days after application will provide quackgrass control for 6 to 8 weeks.
Postemergent Grass and Broadleaf Herbicides			
metribuzin SENCOR 500 F (500g/L) or metribuzin LEXONE DF (75 DF)	0.6 to 1.1 kg/ha 1.2 to 2.2 L/ha 0.624 to 0.772 kg/ha 0.83 to 1.03 kg/ha	 0.48 to 0.88 L/ac 0.33 to 0.4 kg/ac	Apply early postemergence soon after emergence of the crop and before weeds are 4 cm high. Applications should be made in the afternoon or early evening on sunny days (this allows the enzyme that detoxifies metribuzin to build-up). DO NOT use postemergence on red skinned varieties or on potatoes grown for the early market, or on the Shepody or Atlantic, variety. DO NOT USE ON MUCK SOIL as a residue may injure vegetable crops sown the following season.
rimsulfuron PRISM (25 DF) plus non-ionic surfactant	15 g/ha 60 g/ha 2 L/1000L	 24 g/ac 2 L/1000L	Add a non-ionic surfactant at 2 L per 1000 L of spray solution (0.2% v/v). Always add water soluble packages to clean water with the agitator running. Apply to potatoes prior to initiation of flowering when quackgrass is at 3 to 6 leaf stage (less than 10 cm tall), annual grasses are at 1 to 6 leaf stage and redroot pigweed is in the 4 to 6 leaf stage. DO NOT apply within 30 days of harvest.

Rutabaga

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Soil Applied Grass Herbicides

s-metolachlor DUAL MAGNUM (915g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha	 0.5 to 0.7 L/ac	Apply and incorporate DUAL MAGNUM thoroughly before planting or apply preemergence to the weeds . To control nutsedge and annual nightshade..

Soil Applied Grass and Broadleaf Herbicides

napropamide DEVRINOL DF (50 DF)	1.12 to 2.25 kg/ha 2.25 to 4.5 kg/ha	 0.9 to 1.8 kg/ac	Use lower rates on sandy soils. Apply to well worked soil that is dry enough to permit thorough incorporation to a depth of 2.5 to 5 cm. Incorporate the same day as applied. After harvest, soil should be worked (across the rows if banded) to prevent injury to succeeding crops. Small grains seeded in the fall may be stunted but not otherwise affected.

trifluralin	0.818 to 1.155 kg/ha		See: "Notes on Chemicals" section for details. If shallow cultivation is to be used to control additional broadleaf weeds, it should start when the weeds have reached the 3 to 4 leaf stage. Controls triazine resistant pigweed. Apply and incorporate as directed above.
TREFLAN (480g/L)	1.7 to 2.4 L/ha	0.68 to 0.96 L/ac	
RIVAL DF (60 DF)	1 to 1.9 kg/ha	0.4 to 0.76 kg/ac	
BONANZA 400 (400g/L)	2 to 2.75 L/ha	0.8 to 1.1 L/ac	
fluazifop-p-butyl	0.125 kg/ha		Apply at 2-5 leaf stage of annual grasses. Inter-row cultivation should not occur until 5 days after application. Apply other postemergence herbicides separately at least 3 days after FUSILADE II.
FUSILADE II (125g/L)	1 L/ha	0.4 L/ac	
fluazifop-p-butyl	0.25 kg/ha		Apply at 3-5 leaf stage of quackgrass and wire stemmed muhly. Thorough preplant tillage to fragment quackgrass rhizomes improves control. Inter-row cultivation should not occur until 5 days after application. Apply other postemergence herbicides separately at least 3 days after FUSILADE II.
FUSILADE II (125g/L)	2 L/ha	0.8 L/ac	
clopyralid	0.2 kg/ha		Apply when ragweed plants are 5-10 cm tall. Make only one application per season. Pre-harvest interval is 83 days. For a broad spectrum weed control use as a follow up to a trifluralin or metolachlor application.
LONTREL 360 (360g/L)	0.56 L/ha	0.22 L/ac	

Specialty Vegetables

Includes Chinese broccoli, Chinese cabbage, kohlrabi, mustard cabbage, Chinese radish, fuzzy squash and snow peas.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

imazethapyr	0.075 kg/ha		Only apply once per year. Apply in 200 L/ha (80 L/ac). Allow a preharvest interval of 60 days. For use on snow peas only.
PURSUIT (240g/L)	0.312 L/ha	0.125 L/ac	
napropamide	1.12 to 2.25 kg/ha		Apply either preplant or preemergence. Consult product label for more information. Use the lower rate on light soils (coarse textured-sandy and sandy loam). One application per year ground only. DO NOT harvest within 60 days. Usual rotational crop restrictions apply. After harvest, soil should be worked (across rows if banded) to prevent injury to succeeding crops. Small grains seeded in the fall may be stunted but not otherwise affected. Use on seeded Chinese broccoli, mustard, cabbage, Chinese radish, Chinese cabbage, transplanted Chinese cabbage and kohlrabi.
DEVRINOL DF (50 DF)	2.25 to 4.5 kg/ha	0.9 to 1.8 kg/ac	
napropamide	1.5 kg/ha		Requires rainfall or sufficient irrigation to wet the soil to a depth of 5 to 10 cm soon after application. Some crop stunting may be observed but this should not affect yield. For use on fuzzy squash only.
DEVRINOL DF (50 DF)	3 kg/ha	1.2 kg/ac	

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 1 L/ha	 0.13 to 0.19 L/ac 0.4 L/ac	Crops are tolerant to sethoxydim at any stage of growth. Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after treatment. Apply using 110-200 L/ha (44-80 L/ac) water volume. Use on Chinese broccoli, Chinese cabbage, kohlrabi, mustard cabbage and Chinese radish only.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 1 to 2 L/ha	 0.45 L/ac 0.4 to 0.8 L/ac	Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass in 110-200 L/ha (44-80 L/ac) water. Use MERGE at a rate of 1% v/v. Crop competition and inter-row cultivation 7 to 14 days after application will provide quackgrass control for 6 to 8 weeks. Use on Chinese broccoli, Chinese cabbage, kohlrabi, mustard cabbage and Chinese radish only.
clopyralid LONTREL 360 (360g/L)	0.20 kg/ha 0.56 L/ha	 0.2 L/ac	Nappa Cabbage, Chinese Radish, Mustard Cabbage, Chinese Broccoli - Apply as a ground application in 300 L water/ha. Use only one application per year, no closer than 30 days to harvest. Treat when weeds are young and actively growing. Will not control weeds that emerge after treatment.

Spinach

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

cycloate RO-NEET (720g/L)	3.4 kg/ha 4.75 L/ha	 1.9 L/ac	Preplant incorporated on mineral soils only. RO-NEET should be applied to a dry soil surface before planting, and incorporated within 10 minutes with a double disk. A second incorporation at right angles in tandem with a harrow should follow as soon as possible. Use the lower rate on sandy soils.
chlorpropham CIPC EC (480g/L)	1.3 to 5 kg/ha 2.7 to 10.4 L/ha	 1.08 to 4.16 L/ac	Preemergence on mineral soils only. Chlorpropham should be used at higher rates during warm weather (between May 1 to October 15) on heavy soils. Use lower rates during cool season (between October 15 to May 1) and on sandy loam soils.

Sugar beets (Processing)

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

cycloate RO-NEET (720g/L)	4.5 to 5.58 kg/ha 6.25 to 7.75 L/ha	 2.5 to 3.1 L/ac	Use mineral soils only. Apply in 200 to 400 L/ha (80-160 L/ac) water. Incorporate immediately. Use lower rate on sandy soil. DO NOT apply ethofumesate preemergence.
pyrazon PYRAMIN FL (430g/L)	3.55 to 4.41 kg/ha 8.25 to 10.25 L/ha	 3.3 to 4.1 L/ac	Apply to moist soil in 200 to 500 L/ha (80-200 L/ac) water. Use lower rate on soils less than 3% matter. Incorporate ppi applications no deeper than 5 cm. Can be applied pre and ppi. Pre applications require rainfall or irrigation for activation.
ethofumesate NORTRON SC (480 g/L)	1.54 to 3.96 kg/ha 3.2 to 8.25 L/ha	 1.28 to 3.3 L/ac	For mineral soils only. Can be applied pre and ppi. Incorporate ppi applications shallowly. Use lower rate on soil with less than 3% organic matter. Apply in 110 to 560 L/ha (44-224 L/ac) water. DO NOT rotate to other crops for 12 months.
ethofumesate NORTRON SC (480 g/L) plus cycloate RO-NEET (720g/L)	1.41 to 2.88 kg/ha 3.5 to 6 L/ha 3.75 to 5.25 kg/ha 5.2 to 7.3 L/ha	 1.4 to 2.4 L/ac 2.1 to 2.9 L/ac	Use on mineral soils only. Use lower rates on soils less than 3% organic matter. Apply in 110 to 560 L/ha (44-224 L/ac) water and incorporate shallowly. DO NOT rotate to other crops for 12 months.
pyrazon PYRAMIN FL (430g/L) plus ethofumesate NORTRON SC (480g/L)	2.26 kg/ha 5.25 L/ha 1.75 kg/ha 3.65 L/ha	 2.1 L/ac 1.46 L/ac	Make one application per year before weeds emerge. Do not apply to soil with less than 2% organic matter. Do not rotate to crops other than sugar beets for 12 months after application.
quizalofop p-ethyl ASSURE II (96g/L) plus CANPLUS 411 or SURE-MIX	0.036 to 0.072 kg/ha 0.38 to 0.75 L/ha 5 - 10 L/1000L 5 L/1000L	 0.15 to 0.30 L/ac 5 - 10 L/1000L 5 L/1000L	Apply to emerged annual grasses and volunteer cereals in 2 leaf to tillering stage and volunteer corn and quackgrass in the 2 to 6 leaf stage. Apply before the crop canopy closes to maximize spray coverage. Use the 0.15 L/ac rate for control of annual grasses and volunteer cereals. Use the 0.3 L/ac rate to control annual grasses, volunteer cereals and quackgrass. If a second flush of annual grasses or volunteer cereals is observed, apply an additional (sequential) application of ASSURE II at 0.15 L/ac. DO NOT exceed an accumulative, seasonal use rate of 0.3 L/ac of ASSURE II per year. DO NOT apply within 80 days of harvest.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 0.5 to 1 L/ha	 0.13 to 0.19 L/ac 0.2 to 0.4 L/ac	Apply in 50 to 110 L/ha (20-44 L/ac) water. Grasses should be actively growing in the 2-5 leaf (annual grass) stage. DO NOT apply within 85 days of harvest.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 0.5 to 1 L/ha	 0.45 L/ac 0.2 to 0.4 L/ac	Grasses should be actively growing in the 3 leaf (quackgrass) stage.
clopyralid LONTREL 360 (360g/L)	Consult label and your processor for application rates		Emerged Canada thistle. Apply when sugar beets are in cotyledon to 8 leaf stage. DO NOT apply within 90 days of harvest.
desmedipham BETANEX (150 g/L)	Consult label and your processor for application rates		Pigweed, lamb's-quarters, mustard. Apply in 200 to 400 L/ha (80-160 L/ac) water before weeds have 4 true leaves, after sugar beets have at least 2 true leaves. Can apply a 2nd application at least 7 days later.
pyrazon PYRAMIN FL (430g/L) plus surfactant CITOWETT PLUS	Consult label and your processor for application rates		Apply after beets have 2.5 cm true leaves, but before weeds have 3 true leaves. Use 300 to 400 L/ha (120-160 L/ac) water. Avoid hot temperatures. DO NOT use on soils with less than 3% organic matter.
triflusulfuron-methyl UPBEET (50 DF) plus desmedipham/phenmedipham BETAMIX ((1:1) 150g/L)	17.5 to 35 g/ha 35 to 70 g/ha 0.26 to 0.53 kg/ha 1.75 to 3.5 L/ha	 14 to 28 g/ac 0.7 to 1.4 L/ac	Make 2 applications 5 to 10 days apart, or as weeds emerge, to weeds less than 4 leaves. Best control is obtained if weeds have less than 2 leaves. Use the closer sequential if the first application was applied to 5 cm (4 true leaves) weeds. Use the higher rate for larger weeds and denser weed populations. Do not use an adjuvant with this tankmix. Do not use more than 100 g/ha of UPBEET in a season. Apply to actively growing weeds and sugar beets. Yellowing of the crop may occur, but sugar beets will recover. Timely cultivation will improve weed control. Do not apply closer than 60 days to harvest.
triflusulfuron-methyl UPBEET (50 DF) plus non-ionic surfactant AGRAL 90, AG-SURF or CITOWETT PLUS or plus adjuvant SURE-MIX	17.5 to 35 g/ha 35 to 70 g/ha 0.25% v/v 2.5 L/1000 L 0.25% v/v 2.5 L/1000 L	 14 to 28 g/ac 2.5 L/1000 L 2.5 L/1000 L	Velvetleaf. Make 2 applications 5-10 days apart. Apply when velvetleaf has less than 2 leaves. Use the higher rate for larger weeds and denser weed populations. Do not use more than 100 g/ha of UPBEET in a season. Apply to actively growing weeds and sugar beets. Yellowing of the crop may occur, but sugar beets will recover. Do not apply closer than 60 days to harvest.
desmedipham/phenmedipham (1:1) BETAMIX (75 g/L: 75 g/L)	Consult label and your processor for application rates		Apply in 200 to 400 L/ha (80-160 L/ac) water after sugar beets have at least 2 true leaves. Best results when weeds have less than 2 true leaves. Temporary injury may result. Can apply a 2nd applications at least 7 days.

desmedipham/phenmedipham (1:1) BETAMIX (75 g/L: 75 g/L) plus endothall HERBICIDE 273 (360g/L)	Consult label and your processor for application rates		Apply in 200 to 400 L/ha (80-160 L/ac) water after beets have at least 2 true leaves. Best results when weeds have less than 2 true leaves. Use lower rates on smaller beets, or beets under stress.
endothall HERBICIDE 273 (360g/L)	Consult label and your processor for application rates		Apply in 90 to 250 L/ha (36-100 L/ac) water when beets are in the 4-6 leaf stage, but before weeds are large. DO NOT apply later than 40 days after emergence. Temporary injury may result.

Sweet Potatoes

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 1.0 to 2.0 L/ha	 0.13 to 0.19 L/ac 0.4 to 0.8 L/ac	Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while the crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after treatment. Apply using 110 L/ha (44 L/ac) water.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 1.0 to 2.0 L/ha	 0.45 L/ac 0.4 to 0.8 L/ac	Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass. Apply in 110 to 200 L/ha (44-80 L/ac) water. Use MERGE at a rate of 1% v/v. Crop competition inter-row cultivation 7 to 14 days after application will provide quackgrass control for 6 to 8 weeks.

Tomatoes (Transplanted)

All treatments should be applied in 150 to 300 L/ha (60-120 L/ac) water unless otherwise specified.

Weed control in tomatoes usually consists of a combination of chemical weed control and cultivation. Crop rotation is also beneficial in the control of weeds. Cultivation should be shallow to prevent bringing untreated soil to the surface which may result in another flush of weeds. When tomatoes are grown on raised beds and beds are reshaped during the course of the season, it may be necessary or useful to apply another herbicide treatment to areas between the rows to prevent a new weed infestation from interfering with harvesting. Do not exceed the total recommended rate per season of any herbicide applied more than once per year.

Band treatment of herbicides over the row will reduce the cost by one-half to two-thirds depending on the width of the band compared to the row spacing. Shallow inter-row cultivation will be required for weed control between the rows.

Perennial weeds may be partially controlled by cultivation. Controlling them in crops other than tomatoes when grown in rotation is the best approach to perennial weed control. Perennials are easily spread with cultivators or tillage equipment. Areas of perennial weeds are best tilled last. Machinery sanitation is important when moving from one field to another.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
s-metolachlor DUAL MAGNUM (915g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha	 0.5 to 0.7 L/ac	Applied preplant followed by one incorporation with a double disk or vibrating shank (S-tine) cultivator operating at a depth of 10 cm. Lasts 10-14 weeks in the soil. Effective on most soils except high organic matter, muck or peat soils. Use only on transplant tomatoes grown for processing.
trifluralin TREFLAN (480g/L) RIVAL DF (60 DF) BONANZA 400 (400g/L)	0.6 to 1.105 kg/ha 1.25 to 2.3 L/ha 1 to 1.9 kg/ha 1.5 to 2.75 L/ha	 0.5 to 0.92 L/ac 0.4 to 0.76 kg/ac 0.6 to 1.1 L/ac	Incorporate twice in cross directions using a tandem disc (7-10 km/hr) or vibrating tine cultivator (10-13 km/hr) set to work 8-10 cm deep. The first incorporation should be done as soon as possible after application but may be delayed up to 8 to 24 hours. (See label.) The second incorporation is recommended anytime before planting. See "Notes on Chemicals" section for further details. Cool, wet weather may cause stunting of tomato transplants but yield is not usually affected.
[redacted]			
napropamide DEVRINOL DF (50 DF)	1.12 to 2.25 kg/ha 2.25 to 4.5 kg/ha	 0.9 to 1.8 kg/ac	Use lower rates on lighter soils. Apply to well worked soil that is dry enough to permit thorough incorporation to a depth of 2.5 to 5.0 cm. Incorporate the same day as applied. After harvest, soil should be worked (across rows if banded) to prevent injury to succeeding crops. Small grains seeded in the fall may be stunted but not otherwise affected. Napropamide can be used on field seeded tomatoes. Consult product labels for more information.
s-metolachlor DUAL MAGNUM (915g/L) plus metribuzin SENCOR 500 F (500g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 0.25 to 0.7 kg/ha 0.5 to 1.4 L/ha	 0.5 to 0.7 L/ac 0.2 to 0.56 L/ac	See above recommendations for s-metolachlor. Consult the metribuzin label for additional instructions. Use lower rate of metribuzin for plug plants and repeat applications of metribuzin when crop is established as described under postemergence application of metribuzin. DO NOT exceed total maximum rate of metribuzin recommended for your soil type.
trifluralin TREFLAN (480g/L) plus metolachlor DUAL (960g/L) plus metribuzin SENCOR 500 F (500g/L)	0.528 to 1.008 kg/ha 1.1 to 2.1 L/ha 1.536 to 2.016 kg/ha 1.6 to 2.1 L/ha 0.25 to 0.5 kg/ha 0.5 to 1 L/ha	 0.44 to 0.84 L/ac 0.64 to 0.84 L/ac 0.2 to 0.4 L/ac	Use the lower rates on lighter soils. Apply the spray solution and shallow incorporate (5 to 7.5 cm deep), then transplant 5-10 cm deep. Under cold, wet conditions on light textured soils there may be a delay in transplant establishment. Use only on transplant tomatoes grown for processing.
trifluralin TREFLAN (480g/L) RIVAL DF (60 DF) BONANZA 400 (400g/L) plus metribuzin SENCOR 500 F (500g/L) LEXONE DF (75 DF)	0.6 to 1.105 kg/ha 1.25 to 2.3 L/ha 1 to 1.9 kg/ha 1.5 to 2.75 L/ha 0.25 to 0.7 kg/ha 0.5 to 1.4 L/ha 0.32 to 0.93 kg/ha	 0.5 to 0.92 L/ac 0.4 to 0.76 kg/ac 0.6 to 1.1 L/ac 0.2 to 0.56 L/ac 0.13 to 0.37 kg/ac	Follow incorporation instructions as above for trifluralin. Use only for processing tomatoes. The lower rates are for sandy soils and higher rates for clay soils. Use lower rate of metribuzin for plug plants. See "Remarks" for metolachlor plus metribuzin.
[redacted]			
fenoxaprop-p-ethyl EXCEL SUPER (80.5g/L)	0.054 kg/ha 0.67 L/ha	 0.27 L/ac	Apply to emerged grasses in the 1 to 6 leaf stage which are actively growing while crop is small enough to permit thorough coverage. A second application may be necessary to control grasses emerged after the first treatment. Fenoxaprop-p-ethyl can be used on field seeded tomatoes, consult product label for more information.

fluazifop-p-butyl FUSILADE II (125g/L)	0.075 to 0.25 kg/ha 0.6 to 2 L/ha	 0.24 to 0.8 L/ac	Apply at 0.6 to 1 L/ha at 2 to 5 leaf stage of annual grasses. Apply at 1 to 2 L/ha at 3 to 5 leaf stage of quackgrass and wirestem muhly. Quackgrass top growth is suppressed at 1 L/ha. Thorough preplant tillage, fragmenting quackgrass rhizomes, improves control. Inter-row cultivation should not occur until 5 days after application. DO NOT tank mix with postemergence broadleaf weed herbicide. Apply other postemergence herbicides separately at least 3 days after fluazifop-p-butyl. Fluaziflo-p-butyl can be used on field seeded tomatoes. Consult product label for more information.
sethoxydim POAST ULTRA (450g/L) plus oil concentrate ASSIST or surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha 1 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac 0.4 L/ac	Tomatoes are tolerant to sethoxydim at any stage of growth. Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after application. A second application may be necessary to control grasses that emerge after the first treatment. Water rates of 50 to 200 L/ha (20-80 L/ac) provide the best results. Sethoxydim can be used on field seeded tomatoes. Consult product label for more information.
sethoxydim POAST ULTRA (450g/L) plus oil concentrate ASSIST or surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 4 L/ha 1 to 2 L/ha	 0.45 L/ac 1.6 L/ac 0.4 to 0.8 L/ac	Thorough preplant tillage will result in more uniform quackgrass emergence. Apply at 1 to 3 leaf stage of actively growing quackgrass in 110 to 200 L/ha (44-80 L/ac) water. Crop competition and inter-row cultivation 7 to 14 days after application will ensure quackgrass control for 6 to 8 weeks. Sethoxydim can be used on field seeded tomatoes. Consult product label for more information.
metribuzin LEXONE DF (75 DF) SENCOR 75 DF (75 WG)	0.25 to 0.85 kg/ha 0.32 to 1.1 kg/ha 0.32 to 1.1 kg/ha	 0.13 to 0.44 kg/ac 0.13 to 0.44 kg/ac	Use in processing tomatoes only. Apply before weeds exceed 5 cm in height. Direct spray to bottom one-third of tomato plants to reduce risk of crop injury. Apply 3 weeks after transplanting when tomato plants are established. Avoid application when crop is under stress due to cool, wet cloudy weather or excessively hot temperatures. Some tomato varieties are more sensitive than others. Use lower rates on sandy soils, higher rates on clay soils.
metribuzin SENCOR 500 F (500g/L) LEXONE DF (75 DF)	0.15 kg/ha 0.3 L/ha 0.2 kg/ha	 0.12 L/ac 0.08 kg/ac	Multiple application technique. One to four applications can be applied per season. Apply as a postemergence broadcast spray before the weeds are 4 cm high. Control of annual grasses may not be acceptable. Avoid application when crop is under stress due to cool, wet cloudy weather or excessively high temperatures as crop injury may result. DO NOT harvest within 30 days of application. The fungicide BRAVO 500(chlorothalanil) may be tank mixed with this treatment at the rate of 2.4 to 4.8 L/ha (1.2 to 2.4 kg/ha active). Please refer to the BRAVO 500 label for diseases controlled and specific recommendations.
pyridate LENTAGRAN (45 WP) plus metribuzin LEXONE DF (75 DF) SENCOR 75 DF (75 WG)	0.45 to 0.9 kg/ha 1 to 2.kg/ha 0.15 to 0.3 kg/ha 0.2 to 0.4 kg/ha 0.2 to 0.4 kg/ha	 0.4 to 0.8 kg/ac 0.08 to 0.16 kg/ac 0.08 to 0.16 kg/ac	Use trifluralin ppi and then apply pyridate + metribuzin to actively growing weeds as a directed spray to the bottom (1/3) one-third of well established tomato plants. DO NOT use before tomato plants reach the 5 leaf stage or if the plants are under stress. LENTAGRAN applied over tomato plants (not directed) will cause crop injury.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
rimsulfuron **PRISM (25DF)** **plus non-ionic surfactant**	**15 g/ha** **60 g/ha** **0.2 % v/v**	 **24 g/ac** **0.2 % v/v**	**Add a non-ionic surfactant at 2L per 1000L spray solution (0.2 % v/v). Always add water soluble packages to clean water with the agitator running. Apply up to the 4 leaf stage of hairy nightshade. Apply when quackgrass is at the 3 to 6 leaf stage (less than 10 cm tall), annual grasses are at the 1 to 6 leaf stage and redroot pigweed is at the 4 to 6 leaf stage. DO NOT harvest crop within 30 days of treatment.**

Notes:

Weed control ratings are given as 0-9 where 0 indicates no control and 9 indicates 90%-100% control under ideal conditions.

Ratings are subjective values based on best available information and give general comparisons based on use as descibed in this guide.

Under unfavorable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used.

Ratings in **BOLD** suggest the weed is listed on the product label for control or suppression.

Please see product label for more information on registered weed species, product uses and precautions.

Table 17. Vegetable Herbicide Weed Control Ratings

		Grasses					Annual Broadleaves								Perennials						
Treatment	**Trade Name**	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	buckwheat, wild	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
soil applied grass herbicides																					
cycloate	RO-NEET	**8**	**8**	6	**8**	8	?	?	**7**	5	**7**	**8**	?	?	?	?	?	**6**	?	?	?
EPTC	EPTAM	**9**	**9**	**9**	**9**	**9**	6	7	**7**	5	8	**7**	5	5	?	?	?	**8**	**7**	?	?
napropamide	DEVRINOL	**8**	**9**	**8**	8	8	5	6	**8**	5	5	**8**	**7**	5	5	5	5	6	5	5	5
pendimethalin	PROWL	**9**	**8**	9	**8**	?	?	6	**9**	?	8	**8**	2	6	?	?	?	?	?	?	?
s-metolachlor	DUAL MAGNUM	**9**	**9**	**9**	**9**	**9**	2	2	7	2	**8**	**8**	3	2	0	0	0	**8**	4	0	0
triallate	AVADEX	5	?	?	5	5	5	5	5	5	?	5	5	?	5	?	?	?	?	5	5
soil applied broadleaf herbicides																					
linuron	LOROX, AFOLAN or LINURON 480	**7**	**5**	**5**	**7**	**7**	**8**	**9**	**9**	**9**	8	**9**	**8**	**6**	2	2	2	2	2	2	2
metobromuron	PATORAN	**5**	**5**	5	**5**	**5**	8	**9**	**9**	**9**	**7**	**9**	**8**	6	2	2	2	2	2	2	2
metribuzin	SENCOR, LEXONE	**7**	**6**	**7**	**8**	**8**	7	**9**	**9**	**9**	3	**9**	**8**	**8**	2	2	2	2	2	2	2
monolinuron	AFESIN	**5**	**5**	5	**5**	5	**8**	9	**9**	9	**7**	**9**	**8**	6	2	2	2	2	2	2	2
prometryne	GESAGARD	?	?	?	**9**	?	?	**8**	**9**	**8**	**8**	**8**	6	?	?	?	?	?	?	?	?
pyrazon	PYRAMIN	**5**	**5**	5	**5**	5	**8**	**8**	**8**	8	**8**	**8**	**8**	6	5	5	?	5	5	5	5
soil applied grass and broadleaf herbicides																					
diuron	KARMEX	9	**8**	7	**8**	?	8	8	**9**	8	7	**8**	**9**	?	?	5	?	5	5	5	5
terbacil	SINBAR	**8**	**7**	8	**8**	8	?	7	**8**	**8**	7	**7**	**7**	7	?	5	6	6	6	?	6
chlorpropham	CIPC	8	9	7	8	7	8	8	7	5	?	7	5	?	?	5	?	?	5	5	5
ethofumesate	NORTRON SC	**7**	**6**	7	**7**	7	**8**	**8**	**8**	8	**7**	**8**	8	7	5	5	5	6	5	5	5

Table 17. Vegetable Herbicide Weed Control Ratings

Treatment	Trade Name	Grasses					Annual Broadleaves								Perennials						
		barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	buckwheat, wild	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
imazethapyr	PURSUIT	8	7	7	9	9	8	9	9	9	9	9	8	9	?	?	?	7	5	?	?
naptalam	ALANAP	5	7	5	7	?	5	9	9	6	5	8	5	?	?	5	?	5	5	5	5
propyzamide	KERB	8	8	8	8	8	?	6	6	7	7	0	0	0	0	0	0	0	0	0	0
simazine	PRINCEP NINE-T	9	8	7	9	9	9	9	9	9	9	9	8	5	2	0	0	5	5	2	2
trifluralin	TREFLAN or RIVAL or BONANZA 400	9	9	9	9	9	6	7	8	2	2	8	4	2	2	2	2	2	2	2	2
postemergence grass herbicides																					
propyzamide	KERB	8	8	6	8	?	?	0	0	0	?	6	0	0	0	0	0	0	8	0	0
clethodim	SELECT	9	8	9	8	9	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0
diclofop-methyl	HOE-GRASS 284	8	5	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
fenoxaprop-p-ethyl	EXCEL SUPER	9	8	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
fluazifop-p-butyl	FUSILADE II	8	8	9	8	9	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
sethoxydim	POAST ULTRA	9	8	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
postemergence broadleaf herbicides																					
2,4-D*	2,4-D*	0	0	0	0	0	7	7	9	9	7	9	9	9	7	0	0	0	0	8	8
bentazon	BASAGRAN FORTE	0	0	0	0	0	8	9	8	9	7	8	8	9	5[a]	2	2	8[a]	0	6[a]	7[a]
bromoxynil	PARDNER	0	0	0	0	0	9	9	9	8	9	8	9	9	7	0	0	0	0	7	7
clopyralid	LONTREL	5	5	5	5	5	?	7	5	?	5	5	8	5	5	?	?	5	5	7	7
desmedipham	BETANEX	5	5	5	5	5	5	6	7	7	6	9	9	5	5	?	?	5	5	5	5
desmedipham + phenmedipham	BETAMIX	5	5	5	7	5	6	6	8	7	6	8	8	5	5	?	?	5	5	5	5
herbicidal oil*	herbicidal oil*	?	?	?	?	?	?	6	7	7	?	7	5	?	5	5	5	5	5	5	5
MCPA*	MCPA*	0	0	0	0	0	4	0	9	9	?	9	8	9	7	7	0	0	0	7	7
oxyfluorfen	GOAL 2XL	5	5	5	5	5	9	8	8	9	9	9	8	7	5	5	5	5	5	5	5
pyrazon	PYRAMIN	5	5	?	5	?	8	8	8	8	8	8	8	?	?	5	?	5	5	5	5
pyridate	LENTAGRAN	?	?	?	?	?	?	?	8	?	?	8	?	?	?	?	?	?	?	?	?
postemergence grass and broadleaf herbicides																					

Table 17. Vegetable Herbicide Weed Control Ratings

Treatment	Trade Name	Grasses					Annual Broadleaves								Perennials						
		barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	buckwheat, wild	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
linuron	LOROX, AFOLAN or LINURON 480	**9**	**7**	9	**8**	**9**	**8**	**8**	**8**	8	8	**8**	**8**	**8**	7	8	7	8	7	8	7
metribuzin	SENCOR or LEXONE	**8**	**7**	**9**	**8**	**9**	**7**	**9**	**8**	**9**	?	**8**	**8**	**8**	?	?	?	?	7	?	?
phenmedipham	SPIN-AID	5	5	5	**6**	5	**?**	8	**8**	**?**	7	6	8	7	5	5	5	5	5	5	5
rimsulfuron	PRISM	**9**	8	**9**	**8**[b]	**9**	?	7	**7**	9	4[c]	**9**	3	6	?	?	?	?	**7**	?	?
post (Directed)																					
pyridate + metribuzin	LENTAGRAN + SENCOR or LEXONE	6	5	?	6	?	**7**	**7**	**9**	**8**	**9**	**9**	**9**	**8**	5	5	5	5	5	5	5
preharvest and post harvest																					
glufosinate ammonium	IGNITE	9	9	9	**9**	9	**?**	9	**9**	**9**	?	**9**	9	9	8[d]	7[d]	6[d]	0	8[d]	?	?

* Various formulations available, see Table 1.

? Insufficient information available to make a rating.

[a] Good control of these perennial weeds may require two applications of BASAGRAN + ASSIST oil concentrate about 7 to 10 days apart

[b] Yellow foxtail will only be suppressed.

[c] Registered for control of hairy nightshade

[d] Repeated applications may be necessary if regrowth occurs.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)

Cultural Weed Control in Fruit and Ornamental Crops

A successful weed control program must integrate cultural and chemical weed control practices. Growers cannot depend entirely on chemical weed control in fruit crops, since there is a limited spectrum of herbicides registered for these crops.

PERENNIAL WEED CONTROL

It is important to identify and control perennial weeds in the preplanting year. It is very difficult to control perennial weeds once a planting is established because of crop sensitivity to some herbicides and since it is not possible to clean cultivate in established orchards, vineyards, berry crops and nurseries.

The following perennial weeds present serious problems in these crops; quackgrass, bindweed, vetch, wild grape, perennial nightshade, thistles, ground-ivy (creeping charlie) and burdock. In strawberries, sheep sorrel, toadflax and milkweed also present problems.

Appropriate herbicides such as glyphosate (ROUNDUP) or amitrole (AMITROL 240) should be applied to perennial weeds in the preplanting year. Consult the product label and be sure to use the recommended rate for the weed in question. Apply the herbicide at the proper stage of growth of the weed, otherwise only temporary control will be achieved. Repeated cultivations of some perennial weeds such as bindweed will also provide control.

SITE PREPARATION

A green manure crop such as perennial rye-grass or sudan grass should be established in the preplanting year following or in conjunction with measures to control perennial weeds. This crop will provide competition to reduce weed growth as well as improving the soil structure. Non selective herbicides can be applied before planting the green manure crop and before plowing it under. Short residual selective herbicides such as 2,4-D may be used with the green manure crop, but avoid using herbicides that leave a soil residue that will carry over into the planting year.

MULCHING

A biodegradable plastic mulch could be used for weed control in the planting strip. A straw mulch will also assist in weed control beneath the trees or in the planting strip if it is applied early in the season before the weed seeds germinate. Use mulch that is free of weed seeds and ensure that enough nitrogen is provided for the plants. The mulch should be pulled away from around the tree bases for winter rodent protection. Peastone gravel is another option that can be applied around the base of the trees. It will provide weed control as well as improving drainage, encouraging deeper rooting and discouraging rodents.

REDUCING WEED PRESSURE

Cultivation can provide weed control between the rows. Alternatively, a vigorous sod between the rows will prevent weeds from becoming established. It is better to seed in a fescue sod than to rely on a natural sod composed of weed and grass species, since the weeds will seed into the herbicide strip.

Prevent weeds from setting seed in adjacent uncropped areas by using cultural or chemical weed control measures. Mowing at regular intervals will prevent many weeds from flowering. Try to control weeds which escape before they set seed, by cultural removal or chemical mowing. In some situations, tools such as a weed whip may be of use. Mowers are available which will cut close to the trees without injury. Mowing, however, will not eliminate weed competition.

ROTATING HERBICIDE FAMILIES (SEE HERBICIDE GROUPINGS FOR ONTARIO TABLE)

In perennial crops, rotation of herbicide families is important to minimize the building up of seed from weed escapes, including triazine tolerant weeds. Rotation will also help avoid an accumulation of herbicide residues in the soil that may result in crop injury over a period of years and may hinder replanting.

Apples

Recommended rates /ha or /ac refer to area actually treated with herbicide. Unless specified, apply all treatments in 150 to 300 L/ha (60-120 L/ac) water.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Simazine, napropamide and terbacil residues, high enough to harm many crops, may persist for several years after removal of orchard.

dichlobenil CASORON 4G (4 Gr)	4.4 to 7 kg/ha 110 to 175 kg/ha	 44 to 70 kg/ac	Apply before weeds emerge or after cultivation. 70 g of CASORON 4 G applied to an area 2 x 2 m is equivalent to 175 kg/ha (70 kg/ac). DO NOT apply until 4 weeks after transplanting. DO NOT use on light sandy soils.
metribuzin LEXONE DF (75 DF)	0.38 to 0.75 kg/ha 0.5 to 1 kg/ha	 0.2 to 0.4 kg/ac	Apply as a preplant incorporated treatment in the year of planting. Make a single application as an orchard floor or planting row treatment. Consult label for incorporation instructions.
metribuzin SENCOR 75 DF (75 WG) plus trifluralin TREFLAN (480g/L) BONANZA 400 (400g/L)	0.42 to 0.56 kg/ha 0.55 to 0.75 kg/ha 0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1.5 to 2.75 L/ha	 0.22 to 0.3 kg/ac 0.5 to 0.96 L/ac 0.6 to 1.1 L/ac	Apply and incorporate before planting trees. Apply only once in the year of planting, as an orchard floor or planting row treatment.
napropamide DEVRINOL DF (50 DF)	4.5 kg/ha 9 kg/ha	 3.6 kg/ac	Apply after planting trees, but before weeds emerge. Use a directed spray at low pressure. Incorporation by rainfall or irrigation is essential within 2 days of application.
napropamide DEVRINOL DF (50 DF) plus simazine PRINCEP NINE-T (90WG)	3.5 kg/ha 7 kg/ha 2.025 kg/ha 2.25 kg/ha	 2.8 kg/ac 0.9 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Make only one application in the planting year.
napropamide DEVRINOL DF (50 DF) plus terbacil SINBAR (80 WP)	4.5 kg/ha 9 kg/ha 0.5 kg/ha 0.63 kg/ha	 3.6 kg/ac 0.25 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground or during harvest. Make one application in the planting year only.
s-metolachlor DUAL MAGNUM (915g/L) plus simazine PRINCEP NINE-T (90WG) SIMAZINE 80W (80WP)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 0.99 to 1.98 kg/ha 1.1 to 2.2 kg/ha 1.25 to 2.5 kg/ha	 0.5 to 0.7 L/ac 0.44 to 0.88 kg/ac 0.5 to 1 kg/ac	Apply once in the year of planting only. DO NOT use on sandy soils with less than 2% organic matter. Apply post planting, pre-emergent to weeds, preferably after rain has settled the soil around the trees. Avoid contact with tree trunks and leaves.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
simazine	1 to 2 kg/ha		Apply once per season. Avoid contact with trunk and leaves of trees. DO NOT use on sandy soils with less than 2% organic matter. Apply post planting, preemergent to weeds, preferably after rain has settled the soil around the trees.
PRINCEP NINE-T (90WG)	1.1 to 2.2 kg/ha	0.44 to 0.88 kg/ac	
SIMAZINE 80W (80WP)	1.25 to 2.5 kg/ha	0.5 to 1 kg/ac	
terbacil	1 kg/ha		Apply after planting trees, before weeds emerge. DO NOT use on soils with less than 2% organic matter. Avoid contact with tree trunks and leaves.
SINBAR (80 WP)	1.25 kg/ha	0.5 kg/ac	
trifluralin	0.6 to 1.155 kg/ha		Apply and incorporate before planting trees. Use at least 100 L/ha water (40 L/ac). Apply once in the planting year only.
TREFLAN (480g/L)	1.25 to 2.4 L/ha	0.5 to 0.96 L/ac	
BONANZA 400 (400g/L)	1.5 to 2.75 L/ha	0.6 to 1.1 L/ac	
fluazifop-p-butyl	0.125 kg/ha		Apply to actively growing annual grasses in the 2-5 leaf stage of growth.
FUSILADE II (125g/L)	1 L/ha	0.4 L/ac	
fluazifop-p-butyl	0.25 kg/ha		Treat actively growing quackgrass at the 3-5 leaf stage.
FUSILADE II (125g/L)	2 L/ha	0.8 L/ac	
sethoxydim	0.15 to 0.2 kg/ha		Apply to emerged annual grasses in the 1-6 leaf stage during active growth. Complete grass control is normally obtained 7 to 21 days after application. Use the low rate for annual grasses and the high rate for volunteer grains.
POAST ULTRA (450g/L) plus surfactant/solvent	0.32 to 0.47 L/ha	0.13 to 0.19 L/ac	
MERGE	2 L/ha	0.8 L/ac	
sethoxydim	0.5 kg/ha		Apply to emerged quackgrass up to the 3 leaf stage during active growth. Complete grass control is normally obtained 7 to 21 days after application.
POAST ULTRA (450g/L) plus surfactant/solvent	1.1 L/ha	0.45 L/ac	
MERGE	2 L/ha	0.8 L/ac	
bentazon	0.84 to 1.08 kg/ha		Direct under trees to small actively growing weeds. Avoid tree leaves. Apply in 100 to 400 L/ha water (40-160 L/ac) with at least 275 kPa pressure. Use lower rate of ASSIST under hot, humid conditions. Two applications, 10 days apart at 1.75 L/ha (0.7 L/ac) may be applied in the year of planting only.
BASAGRAN (480g/L) plus oil concentrate	1.75 to 2.25 L/ha	0.7 to 0.9 L/ac	
ASSIST	1 to 2 L/ha	0.4 to 0.8 L/ac	
clopyralid	0.202 kg/ha		Apply in the spring at early flowering stage of vetch as a spot treatment. Avoid contact with tree limbs. DO NOT apply closer than 30 days to harvest.
LONTREL 360 (360g/L)	0.56 L/ha	0.22 L/ac	
propyzamide	2.25 kg/ha		Apply from late September to early November when soil is cool and moist but not frozen. Use only under apple trees established at least one year. 4.5 kg/ha is equivalent to 45 g/100 m².
KERB (50 WP)	4.5 kg/ha	1.8 kg/ac	
s-metolachlor	1.6 kg/ha		Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter.
DUAL MAGNUM (915g/L)	1.75 L/ha	0.7 L/ac	

metribuzin LEXONE DF (75 DF)	0.75 kg/ha 1 kg/ha	 0.4 kg/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with tree trunks and leaves.
dichlobenil CASORON 4G (4Gr)	4.4 to 7 kg/ha 110 to 175 kg/ha	 44 to 70 kg/ac	Apply in fall or early spring before weeds emerge. 70 g of CASORON 4 G applied to an area 2 x 2 m is equivalent to 175 kg/ha. DO NOT use on light sandy soils.
linuron LOROX DF (50 DF) AFOLAN F (480g/L) LINURON 480 (480g/L)	4.5 kg/ha 9 kg/ha 9.4 L/ha 9.4 L/ha	 3.6 kg/ac 3.76 L/ac 3.76 L/ac	Apply as directed spray before weeds are 10 cm high in 400-600 L/ha water (160-240 L/ac). Add a surfactant. Avoid contact with fruit, foliage or tree bark with spray or drift. Use only under trees established at least 10 years.
napropamide DEVRINOL DF (50 DF)	4.5 kg/ha 9 kg/ha	 3.6 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Avoid contact with fruit and foliage. DO NOT apply when fruit is on the ground during harvest.
s-metolachlor DUAL MAGNUM (915g/L) plus metribuzin LEXONE DF (75 DF)	1.6 kg/ha 1.75 L/ha 0.75 kg/ha 1 kg/ha	 0.7 L/ac 0.4 kg/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter.
s-metolachlor DUAL MAGNUM (915g/L) plus simazine PRINCEP NINE-T (90WG)	1.6 kg/ha 1.75 L/ha 2.25 kg/ha 2.5 kg/ha	 0.7 L/ac 1 kg/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter. Late season crabgrass and fall panicum may escape this treatment.
simazine PRINCEP NINE-T (90WG) SIMADEX (500g/L) SIMAZINE 480 (480g/L)	2.25 to 4.5 kg/ha 2.5 to 5 kg/ha 4.5 to 9 L/ha 4.7 to 9.4 L/ha	 1 to 2 kg/ac 1.8 to 3.6 L/ac 1.88 to 3.76 L/ac	Apply in 300 to 1000 L/ha water (120-400 L/ac). Use only under trees planted for one year or more. Use higher rate on perennial weeds such as quackgrass. May be combined with glyphosate.
terbacil SINBAR (80 WP)	1.8 to 3.6 kg/ha 2.25 to 4.5 kg/ha	 0.9 to 1.8 kg/ac	Apply in 1000 L/ha water (400 L/ac). Use only under trees established for at least 3 years.
terbacil SINBAR (80 WP) plus metribuzin LEXONE DF (75 DF)	0.5 kg/ha 0.63 kg/ha 0.75 kg/ha 1 kg/ha	 0.25 kg/ac 0.4 kg/ac	Apply as a band under trees before weeds emerge. Use only one application per year. DO NOT USE on soil coarser than sandy loams with less than 3% organic matter.
fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	 0.4 L/ac	Apply to actively growing annual grasses in the 2-5 leaf stage of growth.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply to actively growing quackgrass in the 3-5 leaf stage of growth.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac	Apply to emerged annual grasses in the 1-6 leaf stage during active growth. Complete grass control is normally obtained 7 to 21 days after application. Use the low rate for annual grasses and the high rate for volunteer grains.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 2 L/ha	 0.45 L/ac 0.8 L/ac	Apply to emerged quackgrass up to the 3 leaf stage during active growth. Complete grass control is normally obtained 7 to 21 days after application.
2,4-D 2,4-D AMINE 600 (560g/L)	0.95 kg/ha 1.7 L/ha	 0.68 L/ac	To control broadleaf weeds, including dandelion, and seedling Canada thistle and sow thistle. Apply in early spring after weeds emerge (but no closer than 80 days to harvest), or postharvest to actively growing weeds. DO NOT apply when useable fruit is on the orchard floor.
clopyralid LONTREL 360 (360g/L)	0.202 kg/ha 0.56 L/ha	 0.22 L/ac	Apply in the spring at early flowering of vetch as a spot treatment. Avoid contact with tree limbs. DO NOT apply closer than 30 days to harvest. For control of emerged vetch.
amitrole AMITROL 240 (231g/L)	2.25 to 3.25 kg/ha 9.4 to 13.5 L/ha	 3.76 to 5.4 L/ac	Spray after weed foliage has fully developed. For grass and poison-ivy control, spray to wet all foliage, stems and suckers to the ground. Keep spray off tree trunks as much as possible. DO NOT USE WITHIN 30 DAYS BEFORE HARVEST. For all emerged weeds including poison ivy.
glufosinate ammonium IGNITE (150g/L)	0.405 to 0.75 kg/ha 2.7 to 5 L/ha	 1.08 to 2 L/ac	Apply as a directed spray before weeds are 30 cm high. Use 110-330 L/ha water (44-132 L/ac). Where weed growth is heavy, use the higher rate and larger water volume. DO NOT harvest until 40 days after application. For trees established at least one year.
glufosinate ammonium IGNITE (150g/L) plus simazine PRINCEP NINE-T (90WG) SIMADEX (500g/L)	0.405 to 0.75 kg/ha 2.7 to 5 L/ha 2.25 to 4.5 kg/ha 2.5 to 5 kg/ha 4.5 to 9 L/ha	 1.08 to 2 L/ac 1 to 2 kg/ac 1.8 to 3.6 L/ac	For control of emerged weeds plus residual control of annual grasses and broadleaf weeds. Use as a directed spray around the bases of trees established at least one year. DO NOT harvest until 40 days after application. See remarks above on glufosinate ammonium and simazine alone.
glyphosate ROUNDUP (356g/L) plus simazine PRINCEP NINE-T (90WG) SIMAZINE 80W (80WP)	0.8 to 4.27 kg/ha 2.25 to 12 L/ha 2 to 4.5 kg/ha 2.25 to 5 kg/ha 2.5 to 5 kg/ha	 0.9 to 4.8 L/ac 0.9 to 2 kg/ac 1 to 2 kg/ac	This tank mix will provide knockdown of emerged weeds and residual control of germinating weeds. See remarks on paraquat and simazine above, as well as "Notes on Chemicals" section.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.81 to 1.26 kg/ha 2.25 to 3.5 L/ha 2.25 to 3.5 L/ha 0.743 to 1.155 kg/ha 2.25 to 3.5 L/ha	 0.9 to 1.4 L/ac 0.9 to 1.4 L/ac 0.9 to 1.4 L/ac	Apply in 200 to 300 L/ha water (80-120 L/ac). Remove all suckers from base of trunks before application. Apply as a directed spray. DO NOT apply to trees with "green" bark in the area of application. DO NOT apply within 30 days before harvest. Use preemergence herbicide to provide residual control of weed seedlings. For information on spot handgun treatment, see "Special Methods of Weed Control". Wiper applicators may also be used - see "Application Technology".

glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	1.71 to 2.52 kg/ha 4.75 to 7 L/ha 4.75 to 7 L/ha 1.568 to 2.31 kg/ha 4.75 to 7 L/ha	 1.9 to 2.8 L/ac 1.9 to 2.8 L/ac 1.9 to 2.8 L/ac	To control quackgrass and Canada thistle. Apply in 200 to 300 L/ha water (80-120 L/ac). Remove all suckers from base of trunks before application. Apply as a directed spray. DO NOT apply to trees with "green" bark in the area of application. DO NOT apply within 30 days before harvest. Use pre-emergence herbicide to provide residual control of weed seedlings. For information on spot handgun treatment, see "Special Methods of Weed Control". Wiper applicators may also be used - see "Application Technology".
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	2.52 to 4.32 kg/ha 7 to 12 L/ha 7 to 12 L/ha 2.31 to 3.96 kg/ha 7 to 12 L/ha	 2.8 to 4.8 L/ac 2.8 to 4.8 L/ac 2.8 to 4.8 L/ac	To control perennial weeds including poison ivy. Apply in 200 to 300 L/ha water (80-120 L/ac). Remove all suckers from base of trunks before application. Apply as a directed spray. DO NOT apply to trees with "green" bark in the area of application. DO NOT apply within 30 days before harvest. Use preemergence herbicide to provide residual control of weed seedlings. For information on spot handgun treatment, see "Special Methods of Weed Control". Wiper applicators may also be used - see "Application Technology".
linuron LOROX DF (50 DF) AFOLAN F (480g/L)	4.5 kg/ha 9 kg/ha 9.36 L/ha	 3.6 kg/ac 3.74 L/ac	Apply as directed spray before weeds are 10 cm high in 400-600 L/ha water (160-240 L/ac). Add a surfactant. Avoid contact with fruit, foliage or tree bark with spray or drift. Use only under trees established at least 10 years.
paraquat GRAMOXONE (200g/L)	1.1 kg/ha 5.5 L/ha	 2.2 L/ac	Apply in 1100 L/ha (440 L/ac) water or apply 55 mL in 10 L of water sprayed to wet weed foliage. Use on trees established one year or more. Paraquat can be used in mixtures with terbacil, napropamide or simazine to provide residual vegetation control as well as a quick knockdown.
paraquat GRAMOXONE (200g/L) plus napropamide DEVRINOL DF (50 DF)	1.1 kg/ha 5.5 L/ha 4.5 kg/ha 9 kg/ha	 2.2 L/ac 3.6 kg/ac	Add DEVRINOL to tank first then agitate and add GRAMOXONE. Apply in 1100 L/ha water (440 L/ac). Use on trees established one year or more.
paraquat GRAMOXONE (200g/L) plus simazine PRINCEP NINE-T (90WG)	1.1 kg/ha 5.5 L/ha 2.25 to 4.5 kg/ha 2.5 to 5 kg/ha	 2.2 L/ac 1 to 2 kg/ac	This tank mix will provide knockdown of emerged weeds and residual control of germinating weeds. See remarks on paraquat and simazine above, as well as "Notes on Chemicals" section.

Apricots

Recommended rates /ha or /ac refer to area actually treated with herbicide. Unless specified, apply all treatments in 150 to 300 L/ha (60-120 L/ac) water.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Simazine, napropamide and terbacil residues, high enough to harm many crops, may persist for several years after removal of orchard.

Active Ingredient TRADE-NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
metribuzin LEXONE DF (75 DF)	0.38 to 0.75 kg/ha 0.5 to 1 kg/ha	 0.2 to 0.4 kg/ac	Apply as a preplant incorporated treatment in the year of planting only. Make single application as an orchard floor or planting row treatment. Consult label for incorporation instructions.
metribuzin SENCOR 75 DF (75 WG) plus trifluralin TREFLAN (480g/L) BONANZA 400 (400g/L)	0.42 to 0.56 kg/ha 0.55 to 0.75 kg/ha 0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1.5 to 2.75 L/ha	 0.22 to 0.3 kg/ac 0.5 to 0.96 L/ac 0.6 to 1.1 L/ac	Apply and incorporate before planting trees. Apply once in the year of planting only.
napropamide DEVRINOL 50W (50 WP) plus terbacil SINBAR (80 WP)	4.5 kg/ha 9 kg/ha 0.5 kg/ha 0.63 kg/ha	 3.6 kg/ac 0.25 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Make one application in the year of planting only.
napropamide DEVRINOL DF (50 DF) plus simazine PRINCEP NINE-T (90WG)	3.5 kg/ha 7 kg/ha 2 kg/ha 2.25 kg/ha	 2.8 kg/ac 0.9 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Make one application in the year of planting only.
s-metolachlor DUAL MAGNUM (915g/L) plus simazine PRINCEP NINE-T (90WG) SIMAZINE 80W (80WP)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 1 to 2 kg/ha 1.1 to 2.2 kg/ha 1.25 to 2.5 kg/ha	 0.5 to 0.7 L/ac 0.44 to 0.88 kg/ac 0.5 to 1 kg/ac	Apply once in the year of planting. DO NOT use on sandy soils with less than 2% organic matter. Apply post planting, preemergent to weeds, preferably after rain has settled the soil around the trees. Avoid contact with tree trunks and leaves.
simazine PRINCEP NINE-T (90WG) SIMAZINE 80W (80WP)	1 to 2 kg/ha 1.1 to 2.2 kg/ha 1.25 to 2.5 kg/ha	 0.44 to 0.88 kg/ac 0.5 to 1 kg/ac	Apply once per season. Avoid contact with trunk and leaves of trees. DO NOT use on sandy soils with less than 2% organic matter. Apply post planting, preemergent to weeds, preferably after rain has settled the soil around the trees.
trifluralin TREFLAN (480g/L) BONANZA 400 (400g/L)	0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1.5 to 2.75 L/ha	 0.5 to 0.96 L/ac 0.6 to 1.1 L/ac	Apply and incorporate before planting trees. Use at least 100 L/ha water (40 L/ac). Apply once in the planting year only.

fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	 0.4 L/ac	Apply to actively growing annual grasses in the 2-5 leaf stage of growth.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Treat actively growing quackgrass at the 3-5 leaf stage.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac	Apply to emerged annual grasses in the 1-6 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application. Use the low rate for annual grasses and the high rate for volunteer grains.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 2 L/ha	 0.45 L/ac 0.8 L/ac	Apply to emerged quackgrass up to the 3 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application.
bentazon BASAGRAN (480g/L) plus surfactant/solvent MERGE	0.84 to 1.08 kg/ha 1.75 to 2.25 L/ha 1 to 2 L/ha	 0.7 to 0.9 L/ac 0.4 to 0.8 L/ac	Direct under trees to small actively growing weeds. Avoid tree leaves. Apply in 100 to 400 L/ha water (40-160 L/ac) with at least 275 kPa pressure. Use lower rate of MERGE under hot, humid conditions. Two applications, 10 days apart at 1.75 L/ha (0.7 L/ac) may be applied in the year of planting only.
s-metolachlor DUAL MAGNUM (915g/L)	1.6 kg/ha 1.75 L/ha	 0.7 L/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter.
metribuzin LEXONE DF (75 DF)	0.75 kg/ha 1 kg/ha	 0.4 kg/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with tree trunks and leaves.
s-metolachlor DUAL MAGNUM (915g/L) plus metribuzin LEXONE DF (75 DF)	1.6 kg/ha 1.75 L/ha 0.75 kg/ha 1 kg/ha	 0.7 L/ac 0.4 kg/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter.
s-metolachlor DUAL MAGNUM (915g/L) plus simazine PRINCEP NINE-T (90WG)	1.6 kg/ha 1.75 L/ha 2.25 kg/ha 2.5 kg/ha	 0.7 L/ac 1 kg/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter. Late season crabgrass and fall panicum may escape this treatment.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
terbacil SINBAR (80 WP) plus metribuzin LEXONE DF (75 DF)	0.5 kg/ha 0.63 kg/ha 0.75 kg/ha 1 kg/ha	 0.25 kg/ac 0.4 kg/ac	Apply as a band under trees before weeds emerge. Use only one application per year. DO NOT USE on soil coarser than sandy loams with less than 3% organic matter.
fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	 0.4 L/ac	Apply to actively growing annual grasses at the 2 to 5 leaf stage of growth.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply to emerged quackgrass at the 3 to 5 leaf stage of growth. Use only one application per year. Grasses emerging after the treatment will not be controlled.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac	Apply to emerged annual grasses in the 1-6 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application. Use the low rate for annual grasses and the high rate for volunteer grains.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 2 L/ha	 0.45 L/ac 0.8 L/ac	Apply to emerged quackgrass up to the 3 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application.
2,4-D 2,4-D AMINE 600 (560g/L)	0.952 kg/ha 1.7 L/ha	 0.68 L/ac	To control broadleaf weeds including dandelions, and seedling Canada thistle and sow-thistle. Apply in early spring after weeds emerge (but no closer than 80 days to harvest), or postharvest to actively growing weeds. DO NOT apply when useable fruit is on the orchard floor.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.81 to 4.32 kg/ha 2.25 to 12 L/ha 2.25 to 12 L/ha 0.742 to 3.96 kg/ha 2.25 to 12 L/ha	 0.9 to 4.8 L/ac 0.9 to 4.8 L/ac 0.9 to 4.8 L/ac	Use higher rates for perennial weeds - see "Apples" section. Apply in 200 to 300 L/ha water (80-120 L/ac). Remove all suckers from base of trunks before application. Apply as a directed spray. DO NOT apply to trees with "green" bark in the area of application. DO NOT apply within 30 days before harvest. Use preemergence herbicide to provide residual control of weed seedlings. For information on spot handgun treatment, see "Special Methods of Weed Control". Wiper applicators may also be used - see "Application Technology".
paraquat GRAMOXONE (200g/L)	1.1 kg/ha 5.5 L/ha	 2.2 L/ac	Apply in 1000 L/ha water (400 L/ac), or apply 55 mL in 10 L water sprayed to wet weed foliage. Use on trees established one year or more.

Cherries & Plums

Recommended rates /ha or /ac refer to area actually treated with herbicide. Unless specified, apply all treatments in 150 to 300 L/ha (60-120 L/ac) water.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Simazine, napropamide and terbacil residues, high enough to harm many crops, may persist for several years after removal of orchard.

dichlobenil CASORON 4G (4 Gr)	4.4 to 7 kg/ha 110 to 175 kg/ha	 44 to 70 kg/ac	Apply before weeds emerge or after cultivation. 70 g of CASORON 4 G applied to an area 2 x 2 m is equivalent to 175 kg/ha (70 kg/ac). DO NOT apply until 4 weeks after transplanting. DO NOT use on light, sandy soil.
metribuzin LEXONE DF (75 DF)	0.38 to 0.75 kg/ha 0.5 to 1 kg/ha	 0.2 to 0.4 kg/ac	Registered on cherries only. Apply as a preplant incorporated treatment in the year of planting only. Make a single application as a broadcast treatment or within the planting row. Consult label for incorporation instructions.
metribuzin SENCOR 75 DF (75 WG) plus trifluralin TREFLAN (480g/L) BONANZA 400 (400g/L)	0.42 to 0.56 kg/ha 0.55 to 0.75 kg/ha 0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1.5 to 2.75 L/ha	 0.22 to 0.3 kg/ac 0.5 to 0.96 L/ac 0.6 to 1.1 L/ac	Apply and incorporate before planting trees. Apply only once in the year of planting.
napropamide DEVRINOL DF (50 DF) plus simazine PRINCEP NINE-T (90WG)	3.5 kg/ha 7 kg/ha 2 kg/ha 2.25 kg/ha	 2.8 kg/ac 0.9 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Make one application in the planting year only.
napropamide DEVRINOL DF (50 DF) plus terbacil SINBAR (80 WP)	4.5 kg/ha 9 kg/ha 0.5 kg/ha 0.63 kg/ha	 3.6 kg/ac 0.25 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Make one application in the planting year only.
s-metolachlor DUAL MAGNUM (915g/L) plus simazine PRINCEP NINE-T (90WG) SIMAZINE 80W (80WP)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 1 to 2 kg/ha 1.1 to 2.2 kg/ha 1.25 to 2.5 kg/ha	 0.5 to 0.7 L/ac 0.44 to 0.88 kg/ac 0.5 to 1 kg/ac	Apply once in the year of planting. DO NOT use on sandy soils with less than 2% organic matter. Apply post planting, preemergent to weeds, preferably after rain has settled the soil around the trees. Avoid contact with tree trunks and leaves.
terbacil SINBAR (80 WP)	1 kg/ha 1.25 kg/ha	 0.5 kg/ac	Apply after planting trees, before weeds emerge. DO NOT use on soils with less than 2% organic matter. Avoid contact with tree trunks and leaves.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
trifluralin	0.6 to 1.155 kg/ha		Apply and incorporate before planting trees. Use at least 100 L/ha water (40 L/ac). Apply once in the planting year only.
TREFLAN (480g/L)	1.25 to 2.4 L/ha	0.5 to 0.96 L/ac	
BONANZA 400 (400g/L)	1.5 to 2.75 L/ha	0.6 to 1.1 L/ac	
sethoxydim	0.15 to 0.2 kg/ha		Apply to emerged annual grasses in the 1-6 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application. Use the low rate for annual grasses and the high rate for volunteer grains.
POAST ULTRA (450g/L) plus surfactant/solvent	0.32 to 0.47 L/ha	0.13 to 0.19 L/ac	
MERGE	2 L/ha	0.8 L/ac	
sethoxydim	0.5 kg/ha		Apply to emerged quackgrass up to the 3 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application.
POAST ULTRA (450g/L) plus surfactant/solvent	1.1 L/ha	0.45 L/ac	
MERGE	2 L/ha	0.8 L/ac	
bentazon	0.84 to 1.08 kg/ha		Registered on cherries only. Direct under trees to small actively growing weeds. Avoid tree leaves. Apply in 100 to 400 L/ha water (40-160 L/ac)with at least 275 kPa pressure. Use lower rate of ASSIST under hot, humid conditions. Two applications, 10 days apart at 1.75 L/ha (0.7 L/ac) may be applied in the year of planting only.
BASAGRAN (480g/L) plus oil concentrate	1.75 to 2.25 L/ha	0.7 to 0.9 L/ac	
ASSIST	1 to 2 L/ha	0.4 to 0.8 L/ac	
s-metolachlor	1.6 kg/ha		Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter.
DUAL MAGNUM (915g/L)	1.75 L/ha	0.7 L/ac	
metribuzin	0.75 kg/ha		Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with tree trunks and leaves.
LEXONE DF (75 DF)	1 kg/ha	0.4 kg/ac	
dichlobenil	4.4 to 7 kg/ha		Apply in late fall or spring before weeds emerge. 70 g of CASORON 4 G applied to an area 2 x 2 m is equivalent to 175 kg/ha (70 kg/ac). DO NOT use on light, sandy soil.
CASORON 4G (4 Gr)	110 to 175 kg/ha	44 to 70 kg/ac	
linuron	4.5 kg/ha		Apply in 400 to 600 L/ha water (160-240 L/ac) as directed spray before weeds are 10 cm high. Use only under trees established for 10 years. Keep spray off leaves and green bark of trees.
LOROX DF (50 DF)	9 kg/ha	3.6 kg/ac	
AFOLAN F (480g/L)	9.36 L/ha	3.74 L/ac	
LINURON 480 (480g/L)	9.36 L/ha	3.74 L/ac	
s-metolachlor	1.6 kg/ha		Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter.
DUAL MAGNUM (915g/L)	1.75 L/ha	0.7 L/ac	
plus metribuzin	0.75 kg/ha		
LEXONE DF (75 DF)	1 kg/ha	0.4 kg/ac	

s-metolachlor DUAL MAGNUM (915g/L) plus simazine PRINCEP NINE-T (90WG)	1.6 kg/ha 1.75 L/ha 2.25 kg/ha 2.5 kg/ha	 0.7 L/ac 1 kg/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter. Late season crabgrass and fall panicum may escape this treatment.
terbacil SINBAR (80 WP) plus metribuzin LEXONE DF (75 DF)	0.5 kg/ha 0.63 kg/ha 0.75 kg/ha 1 kg/ha	 0.25 kg/ac 0.4 kg/ac	Registered on cherries only. Apply as a band under trees before weeds emerge. Use only one application per year. DO NOT USE on soil coarser than sandy loams with less than 3% organic matter.
[redacted]			
fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	 0.4 L/ac	Apply to actively growing annual grasses at the 2 to 5 leaf stage of growth.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply to emerged quackgrass at the 3 to 5 leaf stage of growth. Use only one application per year. Grasses emerging after the treatment will not be controlled.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac	Apply to emerged annual grasses in the 1-6 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application. Use the low rate for annual grasses and the high rate for volunteer grains.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 2 L/ha	 0.45 L/ac 0.8 L/ac	Apply to emerged quackgrass up to the 3 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application.
[redacted]			
2,4-D 2,4-D AMINE 600 (560g/L)	0.952 kg/ha 1.7 L/ha	 0.68 L/ac	To control broad leaf weeds including dandelions, and seedling Canada thistle and sow-thistle. Apply in early spring after weeds emerge (but no closer than 80 days to harvest), or postharvest to actively growing weeds. DO NOT apply when useable fruit is on the orchard floor.
[redacted]			
glufosinate ammonium IGNITE (150g/L)	0.405 to 0.75 kg/ha 2.7 to 5 L/ha	 1.08 to 2 L/ac	Registered on plums only. Apply as a directed spray before weeds are 30 cm high. Use 110-330 L/ha water (44-132 L/ac). Where weed growth is heavy, use the higher rate and larger water volume. DO NOT harvest until 40 days after application. For trees established at least one year.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.81 to 4.32 kg/ha 2.25 to 12 L/ha 2.25 to 12 L/ha 0.742 to 3.96 kg/ha 2.25 to 12 L/ha	 0.9 to 4.8 L/ac 0.9 to 4.8 L/ac 0.9 to 4.8 L/ac	Use higher rates for perennial weeds - see "Apples" section. Apply in 200 to 300 L/ha water (80-120 L/ac). Remove all suckers from base of trunks before application. Apply as a directed spray. DO NOT apply to trees with "green" bark in the area of application. DO NOT apply within 30 days before harvest. Use preemergence herbicide to provide residual control of weed seedlings. For information on spot handgun treatment, see "Special Methods of Weed Control". Wiper applicators may also be used - see "Application Technology".

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
linuron LOROX DF (50 DF) AFOLAN F (480g/L) LINURON 480 (480g/L)	4.5 kg/ha 9 kg/ha 9.36 L/ha 9.36 L/ha	 3.6 kg/ac 3.74 L/ac 3.74 L/ac	Apply in 400 to 600 L/ha water (160-240 L/ac) as directed spray before weeds are 10 cm high. Use only under trees established for 10 years. Keep spray off leaves and green bark of trees.
paraquat GRAMOXONE (200g/L)	1.1 kg/ha 5.5 L/ha	 2.2 L/ac	Apply in 1000 L/ha water (400 L/ac), or apply 55 mL in 10 L water sprayed to wet weed foliage. Use on trees established one year or more. Under trees established at least 10 years, linuron can be tank mixed with paraquat to provide residual weed control.

Grapes

Recommended rates /ha or /ac refer to area actually treated with herbicide. Unless specified, apply all treatments in 150 to 300 L/ha (60-120 L/ac) water.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Cultural Weed Control - See CULTURAL WEED CONTROL IN FRUIT AND ORNAMENTAL CROPS

Hilling the vines at regular intervals throughout the year will aid in weed control. Be aware that this disruption of the soil will also disturb any residual herbicides. The use of cultivation, mulch or rye cover crops between the rows will provide better water penetration as well as aid in weed control.

Diuron, napropamide and simazine residues, high enough to harm many crops, can persist for several years after the removal of the vineyard.

dichlobenil CASORON 4G (4 Gr)	4.4 to 7 kg/ha 110 to 175 kg/ha	 44 to 70 kg/ac	Apply only to dormant healthy vines which have been established for at least 2 full years. Apply in late fall or spring before weeds emerge.
dichlobenil CASORON 4G (4 Gr)	7 to 9 kg/ha 175 to 225 kg/ha	 70 to 90 kg/ac	Apply only to dormant, healthy vines that have been established at least two full years. Apply in late fall or spring before weeds emerge. For quackgrass, thistles, bindweed and perennial weeds.
diuron KARMEX (80 DF)	1.8 to 5.36 kg/ha 2.25 to 6.7 kg/ha	 0.9 to 2.68 kg/ac	Use only in vineyards established for at least 3 years. Apply in at least 300 L/ha water (120 L/ac) actually sprayed. Apply as a directed spray to a 1 m strip under vines. Where weed growth is heavy, a rate of 4.5 kg/ha (1.8 kg/ac) KARMEX (80 DF) is usually sufficient, except on heavy clay soils or on soils with a high organic matter content. Then the rate should be increased to 6.7 kg/ha. A maintenance application of 2.25 kg/ha (0.9 kg/ac) KARMEX (80 DF) should be sufficient if applied before weed seeds germinate. Applications may be made in the spring or fall or both, but the total amount applied in one year should not exceed 4.5 kg/ha (1.8 kg/ac) KARMEX (80 DF), except on heavy clay or high organic matter soils as noted above. May be tank mixed with paraquat.
napropamide DEVRINOL 50W (50 WP)	4.5 kg/ha 9 kg/ha	 3.6 kg/ac	Use only under vines which have been established at least one year. Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Avoid contact with fruit and foliage.

simazine	3.6 to 4.5 kg/ha		Use only in vineyards established for at least 3 years. Apply in at least 300 L/ha water (120 L/ac) actually sprayed. Established dandelions, field bindweed and quackgrass will not be controlled. Should control plantain.
PRINCEP NINE-T (90WG)	4 to 5 kg/ha	1.6 to 2 kg/ac	
SIMADEX (500g/L)	7.2 to 9 L/ha	2.9 to 3.6 L/ac	
SIMAZINE 480 (480g/L)	7.5 to 9.4 L/ha	3 to 3.76 L/ac	
glufosinate ammonium	0.405 to 0.75 kg/ha		For vines established at least 3 years. Apply as a directed spray before annual weeds are 30 cm high. Avoid green bark. Use 110-330 L/ha water (44-132 L/ac) . Where weed growth is heavy, use the higher rate and larger water volume. DO NOT harvest until 40 days after application.
IGNITE (150g/L)	2.7 to 5 L/ha	1.08 to 2 L/ac	
glufosinate ammonium	0.405 to 0.75 kg/ha		Use as a directed spray avoiding green bark on vines established at least 3 years. For control of emerged annual weeds plus residual control of annual grasses and broadleaf weeds. DO NOT harvest until 40 days after application. See remarks above on IGNITE and simazine alone.
IGNITE (150g/L)	2.7 to 5 L/ha	1.08 to 2 L/ac	
plus simazine	3.6 to 4.5 kg/ha		
PRINCEP NINE-T (90WG)	4 to 5 kg/ha	1.6 to 2 kg/ac	
SIMADEX (500g/L)	7.2 to 9 L/ha	2.88 to 3.6 L/ac	
glyphosate	0.81 to 1.26 kg/ha		For emerged annual grasses and broadleaves. DO NOT use on vines less than 3 years old. Apply in 200 to 300 L/ha water (80-120 L/ac) actually sprayed. Use preemergence herbicides to provide residual control of weed seedlings. DIRECT SPRAY TO AVOID LEAVES AND GREEN STEMS OF GRAPEVINES. For information on spot handgun treatment, see "Special Methods of Weed Control". Wiper applicators may also be used - see "Application Technology". DO NOT use within 14 days of harvest. Use higher rate for larger annual weeds.
ROUNDUP TRANSORB (360g/L)	2.25 to 3.5 L/ha	0.9 to 1.4 L/ac	
GLYFOS (360g/L)	2.25 to 3.5 L/ha	0.9 to 1.4 L/ac	
or glyphosate TMS	0.742 to 1.155 kg/ha		
TOUCHDOWN 480 (330g/L)	2.25 to 3.5 L/ha	0.9 to 1.4 L/ac	
glyphosate	1.71 to 4.32 kg/ha		For emerged quackgrass and broadleaf perennials. DO NOT use on vines less than 3 years old. Apply in 200 to 300 L/ha water (80-120 L/ac) actually sprayed. DIRECT SPRAY TO AVOID LEAVES AND GREEN STEMS OF GRAPEVINES. Use preemergence herbicides to provide residual control of weed seedlings. For information on spot handgun treatment, see "Special Methods of Weed Control". Wiper applicators may also be used - see "Application Technology". DO NOT use within 14 days of harvest. Apply at early bud stage of Canada thistle. Use lower rates for quackgrass and Canada thistle, higher rates for perennial broadleaf weeds and tall weed growth.
ROUNDUP TRANSORB (360g/L)	4.75 to 12 L/ha	1.9 to 4.8 L/ac	
GLYFOS (360g/L)	4.75 to 12 L/ha	1.9 to 4.8 L/ac	
or glyphosate TMS	1.565 to 3.96 kg/ha		
TOUCHDOWN 480 (330g/L)	4.75 to 12 L/ha	1.9 to 4.8 L/ac	
glyphosate	0.81 to 4.32 kg/ha		Use only in vineyards established at least 3 years. This tank mix will provide knockdown of emerged weeds and residual control of germinating weeds. Apply in at least 300 L/ha water (120 L/ac) actually sprayed. Direct spray to avoid leaves and green stems of grapevines. Use higher rates for perennial weeds and heavy weed infestations. DO NOT use within 14 days of harvest.
ROUNDUP TRANSORB (360g/L)	2.25 to 12 L/ha	0.9 to 4.8 L/ac	
or glyphosate TMS	0.74 to 3.96 kg/ha		
TOUCHDOWN 480 (330g/L)	2.25 to 12 L/ha	0.9 to 4.8 L/ac	
plus simazine	2.25 to 4.5 kg/ha		
PRINCEP NINE-T (90WG)	2.5 to 5 kg/ha	1 to 2 kg/ac	
SIMAZINE 80W (80WP)	2.81 to 5.63 kg/ha	1.12 to 2.25 kg/ac	
paraquat	1.1 kg/ha		Apply in 1000 L/ha water (400 L/ac) or apply 55 mL in 10 L water sprayed to wet weed foliage. Use on vines established on trellises. Paraquat can be used in a tank mix with diuron.
GRAMOXONE (200g/L)	5.5 L/ha	2.2 L/ac	

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
paraquat GRAMOXONE (200g/L) plus MCPB/MCPA (15:1) TROPOTOX PLUS (400g/L)	1.1 kg/ha 5.5 L/ha 1.1 kg/ha 2.75 L/ha	 2.2 L/ac 1.1 L/ac	Apply in 1000 L/ha water (400 L/ac) or apply 55 mL GRAMOXONE plus 30 mL TROPOTOX PLUS in 10 L water per 100 m². Apply in late May or early June, or for bindweed control, when bindweed starts to bloom. MCPB/MCPA SPRAY OR DRIFT CAN INJURE GRAPES. Use only when necessary as a spot treatment. Use a hand sprayer or a hand controlled wand fitted with a shielded nozzle. Use a low pressure, coarse spray and direct spray to avoid contact with leaves and stems of grape vines.
paraquat GRAMOXONE (200g/L) plus napropamide DEVRINOL 50W (50 WP)	1.1 kg/ha 5.5 L/ha 4.5 kg/ha 9 kg/ha	 2.2 L/ac 3.6 kg/ac	Add DEVRINOL to tank first then agitate and add GRAMOXONE. Apply in 1100 L/ha water (440 L/ac).

Peaches

Recommended rates /ha or /ac refer to area actually treated with herbicide. Unless specified, apply all treatments in 150 to 300 L/ha (60-120 L/ac) water.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Simazine, napropamide and terbacil residues, high enough to harm many crops, may persist for several years after removal of the orchard.

dichlobenil CASORON 4G (4 Gr)	4.4 to 7 kg/ha 110 to 175 kg/ha	 44 to 70 kg/ac	Apply in late fall or spring before weeds emerge. 70 g of CASORON 4 G applied to an area 2 x 2 m is equivalent to 175 kg/ha (70 kg/ac). DO NOT apply until 4 weeks after transplanting. DO NOT use on light, sandy soil.
metribuzin LEXONE DF (75 DF)	0.38 to 0.75 kg/ha 0.5 to 1 kg/ha	 0.2 to 0.4 kg/ac	Apply and incorporate before planting trees. Make a single application as a broadcast treatment or within the planting row. Consult label for incorporation instructions.
metribuzin SENCOR 75 DF (75 WG) plus trifluralin TREFLAN (480g/L) BONANZA 400 (400g/L)	0.42 to 0.56 kg/ha 0.55 to 0.75 kg/ha 0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1.5 to 2.75 L/ha	 0.22 to 0.3 kg/ac 0.5 to 0.96 L/ac 0.6 to 1.1 L/ac	Apply and incorporate before planting trees. Apply once in the year of planting only as a broadcast treatment or within the planting row.
napropamide DEVRINOL DF (50 DF) plus simazine PRINCEP NINE-T (90WG)	3.5 kg/ha 7 kg/ha 2 kg/ha 2.25 kg/ha	 2.8 kg/ac 0.9 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Make one application in the year of planting.

napropamide	4.5 kg/ha		Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Make one application in the year of planting.
DEVRINOL DF (50 DF)	9 kg/ha	3.6 kg/ac	
plus terbacil	0.5 kg/ha		
SINBAR (80 WP)	0.63 kg/ha	0.25 kg/ac	
s-metolachlor	1.14 to 1.6 kg/ha		Apply once in the year of planting. DO NOT use on sandy soils with less than 2% organic matter. Apply post planting, preemergent to weeds, preferably after rain has settled the soil around the trees. Avoid contact with tree trunks and leaves.
DUAL MAGNUM (915g/L)	1.25 to 1.75 L/ha	0.5 to 0.7 L/ac	
plus simazine	1 to 2 kg/ha		
PRINCEP NINE-T (90WG)	1.1 to 2.2 kg/ha	0.44 to 0.88 kg/ac	
SIMAZINE 80W (80WP)	1.25 to 2.5 kg/ha	0.5 to 1 kg/ac	
simazine	1 to 2 kg/ha		Apply once per season. Avoid contact with trunk and leaves of trees. DO NOT use on sandy soils with less than 2% organic matter. Apply post planting, preemergent to weeds, preferably after rain has settled the soil around the trees.
PRINCEP NINE-T (90WG)	1.1 to 2.2 kg/ha	0.44 to 0.88 kg/ac	
SIMAZINE 80W (80WP)	1.25 to 2.5 kg/ha	0.5 to 1 kg/ac	
terbacil	1 kg/ha		Apply after planting trees, before weeds emerge. DO NOT use on soils with less than 2% organic matter. Avoid contact with tree trunks and leaves.
SINBAR (80 WP)	1.25 kg/ha	0.5 kg/ac	
trifluralin	0.6 to 1.155 kg/ha		Apply and incorporate before planting trees. Use at least 100 L/ha water (40 L/ac). Apply once in the year of planting only as a broadcast treatment or within the planting row.
TREFLAN (480g/L)	1.25 to 2.4 L/ha	0.5 to 0.96 L/ac	
BONANZA 400 (400g/L)	1.5 to 2.75 L/ha	0.6 to 1.1 L/ac	
Y[illegible] (Postemergent Grass Herbicides)			
sethoxydim	0.15 to 0.2 kg/ha		Apply to emerged annual grasses in the 1-6 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application. Use the low rate for annual grasses and the high rate for volunteer grains.
POAST ULTRA (450g/L)	0.32 to 0.47 L/ha	0.13 to 0.19 L/ac	
plus surfactant/solvent			
MERGE	2 L/ha	0.8 L/ac	
sethoxydim	0.5 kg/ha		Apply to emerged quackgrass up to the 3 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application.
POAST ULTRA (450g/L)	1.1 L/ha	0.45 L/ac	
plus surfactant/solvent			
MERGE	2 L/ha	0.8 L/ac	
T[illegible] (Postemergent Broadleaf Herbicides)			
bentazon	0.84 to 1.08 kg/ha		Direct under trees to small actively growing weeds. Avoid tree leaves. Apply in 100 to 400 L/ha water (40-160 L/ac) with at least 275 kPa pressure. Use lower rate of ASSIST under hot, humid conditions. Two applications, 10 days apart at 1.75 L/ha (0.7 L/ac) may be applied in the year of planting only.
BASAGRAN (480g/L)	1.75 to 2.25 L/ha	0.7 to 0.9 L/ac	
plus oil concentrate			
ASSIST	1 to 2 L/ha	0.4 to 0.8 L/ac	
[illegible] (Preemergent Weed Control Herbicides)			
s-metolachlor	1.6 kg/ha		Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter.
DUAL MAGNUM (915g/L)	1.75 L/ha	0.7 L/ac	
[illegible] (Nonselective Vegetation Control)			

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
metribuzin LEXONE DF (75 DF)	0.75 kg/ha 1 kg/ha	 0.4 kg/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with tree trunks and leaves.
dichlobenil CASORON 4G (4 Gr)	4.4 to 7 kg/ha 110 to 175 kg/ha	 44 to 70 kg/ac	Apply in late fall or spring before weeds emerge. 70 g CASORON 4 G applied to an area 2 x 2 m is equivalent to 175 kg/ha (70 kg/ac). DO NOT use on light, sandy soil.
linuron LOROX DF (50 DF) AFOLAN F (480g/L) LINURON 480 (480g/L)	4.5 kg/ha 9 kg/ha 9.36 L/ha 9.36 L/ha	 3.6 kg/ac 3.74 L/ac 3.74 L/ac	Apply in 400 to 600 L/ha water (160-240 L/ac) as a directed spray before weeds are 12 cm high. Use only under peach trees established for over one year. Keep spray off leaves, fruit and green bark of trees. Add a surfactant.
napropamide DEVRINOL 50W (50 WP)	4.5 kg/ha 9 kg/ha	 3.6 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Avoid contact with fruit and foliage.
s-metolachlor DUAL MAGNUM (915g/L) plus metribuzin LEXONE DF (75 DF)	1.6 kg/ha 1.75 L/ha 0.75 kg/ha 1 kg/ha	 0.7 L/ac 0.4 kg/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter.
s-metolachlor DUAL MAGNUM (915g/L) plus simazine PRINCEP NINE-T (90WG)	1.6 kg/ha 1.75 L/ha 2.25 kg/ha 2.5 kg/ha	 0.7 L/ac 1 kg/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter. Late season crabgrass and fall panicum may escape this treatment.
terbacil SINBAR (80 WP)	1.8 to 3.6 kg/ha 2.25 to 4.5 kg/ha	 0.9 to 1.8 kg/ac	Apply in 1000 L/ha of water (400 L/ac). Use only under trees established for at least 3 years. Apply as a band under the trees before weeds emerge. DO NOT use on soils with less than 3% organic matter.
terbacil SINBAR (80 WP) plus metribuzin LEXONE DF (75 DF)	0.5 kg/ha 0.63 kg/ha 0.75 kg/ha 1 kg/ha	 0.25 kg/ha 0.4 kg/ac	Apply as a band under trees before weeds emerge. Use only one application per year. DO NOT USE on soil coarser than sandy loams with less than 3% organic matter.
fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	 0.4 L/ac	Apply to actively growing annual grasses at the 2 to 5 leaf stage of growth. Use only one application per year. Grasses emerging after the treatment will not be controlled.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply to emerged quackgrass at the 3 to 5 leaf stage of grass. Use only one application per year. Grasses emerging after the treatment will not be controlled.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac	Apply to emerged annual grasses in the 1-6 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application. Use the low rate for annual grasses and the high rate for volunteer grains.

sethoxydim POAST ULTRA(450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 2 L/ha	 0.45 L/ac 0.8 L/ac	Apply to emerged quackgrass up to the 3 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application.
2,4-D 2,4-D AMINE 600 (560 g/L)	0.952 kg/ha 1.7 L/ha	 0.68 L/ac	To control emerged broad leaf weeds including dandelions, and seedling Canada thistle and sow-thistle. Apply in early spring after weeds emerge (but no closer than 80 days to harvest), or postharvest to actively growing weeds. DO NOT apply when useable fruit is on the orchard floor.
glufosinate ammonium IGNITE (150g/L)	0.405 to 0.75 kg/ha 2.7 to 5 L/ha	 1.08 to 2 L/ac	Apply as a directed spray before weeds are 30 cm high, avoiding green bark. Use 110-330 L/ha water (44-132 L/ac). Where weed growth is heavy, use the higher rate and larger water volume. DO NOT harvest until 40 days after application. For trees established at least one year.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.81 to 4.32 kg/ha 2.25 to 12 L/ha 2.25 to 12 L/ha 0.74 to 3.96 kg/ha 2.25 to 12 L/ha	 0.9 to 4.8 L/ac 0.9 to 4.8 L/ac 0.9 to 4.8 L/ac	Use higher rates for perennial weed - see "Apples" section. Apply in 200 to 300 L/ha water (80-120 L/ac). Remove all suckers from base of trunks before application. Apply as a directed spray. DO NOT apply to trees with "green" bark in the area of application. DO NOT apply within 30 days before harvest. Use preemergence herbicide to provide residual control of weed seedlings. For information on spot handgun treatment, see "Special Methods of Weed Control". Wiper applicators may also be used - see "Application Technology".
linuron LOROX DF (50 DF) AFOLAN F (480g/L)	4.52 kg/ha 9 kg/ha 9.36 L/ha	 3.6 kg/ac 3.74 L/ac	Apply in 400 to 600 L/ha water (160-240 L/ac) as a directed spray before weeds are 12 cm high. Use only under peach trees established for over one year. Keep spray off leaves, fruit and green bark of trees. Add a surfactant.
paraquat GRAMOXONE (200g/L)	1.1 kg/ha 5.5 L/ha	 2.2 L/ac	Apply in 1000 L/ha water (400 L/ac), or apply 55 mL in 10 L water sprayed to wet weed foliage. Use on trees established one year or more.
paraquat GRAMOXONE (200g/L) plus napropamide DEVRINOL DF (50 DF)	1.1 kg/ha 5.5 L/ha 4.5 kg/ha 9 kg/ha	 2.2 L/ac 3.6 kg/ac	Add DEVRINOL to tank first then agitate and add GRAMOXONE. Apply in 1100 L/ha water (440 L/ac).

Pears

Recommended rates /ha or /ac refer to area actually treated with herbicide. Unless specified, apply all treatments in 150 to 300 L/ha (60-120 L/ac) water.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Simazine, napropamide and terbacil residues, high enough to harm many crops, may persist for several years after removal of the orchard.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
dichlobenil CASORON 4G (4 Gr)	4.4 to 7 kg/ha 110 to 175 kg/ha	 44 to 70 kg/ac	Apply in late fall or spring before weeds emerge. 70 g of CASORON 4 G applied to an area 2 x 2 m is equivalent to 175 kg/ha (70 kg/ac). DO NOT apply until 4 weeks after transplanting. DO NOT use on light, sandy soil.
metribuzin LEXONE DF (75 DF)	0.38 to 0.75 kg/ha 0.5 to 1 kg/ha	 0.2 to 0.4 kg/ac	Apply and incorporate before planting trees. Make a single application as a broadcast treatment or within the planting row. Consult label for incorporation instructions.
metribuzin SENCOR 75 DF (75 WG) plus trifluralin TREFLAN (480g/L) BONANZA 400 (400g/L)	0.42 to 0.56 kg/ha 0.55 to 0.75 kg/ha 0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1.5 to 2.75 L/ha	 0.22 to 0.3 kg/ac 0.5 to 0.96 L/ac 0.6 to 1.1 L/ac	Apply and incorporate before planting trees. Apply once in the year of planting as a broadcast treatment or within the planting row.
napropamide DEVRINOL DF (50 DF) plus simazine PRINCEP NINE-T (90WG)	3.5 kg/ha 7 kg/ha 2 kg/ha 2.25 kg/ha	 2.8 kg/ac 0.9 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Make one application in the planting year.
napropamide DEVRINOL DF (50 DF) plus terbacil SINBAR (80 WP)	4.5 kg/ha 9 kg/ha 0.5 kg/ha 0.63 kg/ha	 3.6 kg/ac 0.25 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Make one application in the year of planting.
s-metolachlor DUAL MAGNUM (915g/L) plus simazine PRINCEP NINE-T (90WG) SIMAZINE 80W (80WP)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha 1 to 2 kg/ha 1.1 to 2.2 kg/ha 1.25 to 2.5 kg/ha	 0.5 to 0.7 L/ac 0.44 to 0.88 kg/ac 0.5 to 1 kg/ac	Apply once in the year of planting. DO NOT use on sandy soils with less than 2% organic matter. Apply post planting, preemergent to weeds, preferably after rain has settled the soil around the trees. Avoid contact with tree trunks and leaves.
terbacil SINBAR (80 WP)	1 kg/ha 1.25 kg/ha	 0.5 kg/ac	Apply after planting trees, before weeds emerge. DO NOT use on soils with less than 2% organic matter. Avoid contact with tree trunks and leaves.

trifluralin TREFLAN (480g/L) BONANZA 400 (400g/L)	0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1.5 to 2.75 L/ha	 0.5 to 0.96 L/ac 0.6 to 1.1 L/ac	Apply and incorporate before planting trees. Use at least 100 L/ha water (40 L/ac). Apply once in the year of planting only as a broadcast treatment or within the planting row.
fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	 0.4 L/ac	Apply to actively growing annual grasses in the 2-5 leaf stage of growth.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply to actively growing quackgrass in the 3-5 leaf stage of growth.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac	Apply to emerged annual grasses in the 1-6 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application. Use the low rate for annual grasses and the high rate for volunteer grains.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 2 L/ha	 0.45 L/ac 0.8 L/ac	Apply to emerged quackgrass up to the 3 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application.
bentazon BASAGRAN (480g/L) plus oil concentrate ASSIST	0.84 to 1.08 kg/ha 1.75 to 2.25 L/ha 1 to 2 L/ha	 0.7 to 0.9 L/ac 0.4 to 0.8 L/ac	Direct under trees to small actively growing weeds. Avoid tree leaves. Apply in 100 to 400 L/ha water (40-160 L/ac) with at least 275 kPa pressure. Use lower rate of ASSIST under hot, humid conditions. Two applications, 10 days apart at 1.75 L/ha (0.7 L/ac) may be applied in the year of planting only.
propyzamide KERB (50 WP)	2.25 kg/ha 4.5 kg/ha	 1.8 kg/ac	Apply from late September to early November when soil is cool and moist but not frozen. Use only under pear trees established for at least one year. 4.5 kg/ha is equivalent to 45 g/100 m².
s-metolachlor DUAL MAGNUM (915g/L)	1.6 kg/ha 1.75 L/ha	 0.7 L/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter.
metribuzin LEXONE DF (75 DF)	0.75 kg/ha 1 kg/ha	 0.4 kg/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with tree trunks and leaves.
dichlobenil CASORON 4G (4 Gr)	4.4 to 7 kg/ha 110 to 175 kg/ha	 44 to 70 kg/ac	Apply in late fall or spring before weeds emerge. 70 g of CASORON 4 G applied in an area 2 x 2 m is equivalent to 175 kg/ha (70 kg/ac). DO NOT use on light, sandy soils.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
linuron LOROX DF (50 DF) AFOLAN F (480g/L) LINURON 480 (480g/L)	4.5 kg/ha 9 kg/ha 9.36 L/ha 9.36 L/ha	 3.6 kg/ac 3.74 L/ac 3.74 L/ac	Apply a directed spray before weeds are 10 cm high in 400 to 600 L/ha water (160-240 L/ac). Add a surfactant. Use only under pear trees established at least 10 years. Avoid contact with fruit, foliage or green bark with spray or drift.
napropamide DEVRINOL DF (50 DF)	4.5 kg/ha 9 kg/ha	 3.6 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Avoid contact with fruit and foliage. Use only under trees established for at least one year.
s-metolachlor DUAL MAGNUM (915g/L) plus metribuzin LEXONE DF (75 DF)	1.6 kg/ha 1.75 L/ha 0.75 kg/ha 1 kg/ha	 0.7 L/ac 0.4 kg/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter.
s-metolachlor DUAL MAGNUM (915g/L) plus simazine PRINCEP NINE-T (90WG)	1.6 kg/ha 1.75 L/ha 2.25 kg/ha 2.5 kg/ha	 0.7 L/ac 1 kg/ac	Apply once per year as a band treatment under the trees before weeds emerge. Avoid contact with trunk and leaves of trees. DO NOT USE on sandy soil with less than 2% organic matter. Late season crabgrass and fall panicum may escape this treatment.
simazine PRINCEP NINE-T (90WG) SIMADEX (500g/L) SIMAZINE 480 (480g/L)	2.25 to 4.5 kg/ha 2.5 to 5 kg/ha 4.5 to 9 L/ha 4.7 to 9.4 L/ha	 1 to 2 kg/ac 1.8 to 3.6 L/ac 1.88 to 3.76 L/ac	Apply in 300 to 1000 L/ha water (120-400 L/ac). Use only under trees planted for one year or more.
terbacil SINBAR (80 WP) plus metribuzin LEXONE DF (75 DF)	0.5 kg/ha 0.63 kg/ha 0.75 kg/ha 1 kg/ha	 0.25 kg/ac 0.4 kg/ac	Apply as a band under trees before weeds emerge. Use only one application per year. DO NOT USE on soil coarser than sandy loams with less than 3% organic matter.
fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	 0.4 L/ac	Apply to actively growing annual grasses in the 2-5 leaf stage of growth.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply to actively growing quackgrass in the 3-5 leaf stage of growth.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac	Apply to emerged annual grasses in the 1-6 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application. Use the low rate for annual grasses and the high rate for volunteer grains.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 2 L/ha	 0.45 L/ac 0.8 L/ac	Apply to emerged quackgrass up to the 3 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application.

2,4-D 2,4-D AMINE 600 (560 g/L)	0.952 kg/ha 1.7 L/ha	0.68 L/ac	To control emerged broadleaf weeds including dandelions, and seedling Canada thistle and sow-thistle. Apply in early spring after weeds emerge (but no closer than 80 days to harvest), or postharvest to actively growing weeds. DO NOT apply when useable fruit is on the orchard floor.
glufosinate ammonium IGNITE (150g/L)	0.405 to 0.705 kg/ha 2.7 to 5 L/ha	1.08 to 2 L/ac	Apply as a directed spray before weeds are 30 cm high. Use 110-330 L/ha water (44-132 L/ac). Where weed growth is heavy, use the higher rate and larger water volume. DO NOT harvest until 40 days after application. For trees established at least one year.
glufosinate ammonium IGNITE (150g/L) plus simazine PRINCEP NINE-T (90WG) SIMADEX (500g/L)	0.405 to 0.75 kg/ha 2.7 to 5 L/ha 2.25 to 4.5 kg/ha 2.5 to 5 kg/ha 4.5 to 9 L/ha	1.08 to 2 L/ac 1 to 2 kg/ac 1.8 to 3.6 L/ac	For control of emerged weeds less than 30 cm high plus residual control of annual grasses and broadleaf weeds. Use as a directed spray around the bases of trees established at least one year. DO NOT harvest until 40 days after application. Apply in 330 L/ha water (132 L/ac). Use higher rates where weed growth is heavy.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	0.81 to 4.32 kg/ha 2.25 to 12 L/ha 2.25 to 12 L/ha 0.742 to 3.96 kg/ha 2.25 to 12 L/ha	 0.9 to 4.8 L/ac 0.9 to 4.8 L/ac 0.9 to 4.8 L/ac	Use higher rates for perennial weed - see "Apples" section. Apply in 200 to 300 L/ha water (80-120 L/ac). Remove all suckers from base of trunks before application. Apply as a directed spray. DO NOT apply to trees with "green" bark in the area of application. DO NOT apply within 30 days before harvest. Use preemergence herbicide to provide residual control of weed seedlings. For information on spot handgun treatment, see "Special Methods of Weed Control". Wiper applicators may also be used - see "Application Technology".
linuron LOROX DF (50 DF) AFOLAN F (480g/L) LINURON 480 (480g/L)	4.5 kg/ha 9 kg/ha 9.36 L/ha 9.36 L/ha	 3.6 kg/ac 3.74 L/ac 3.74 L/ac	Apply as a directed spray before weeds are 10 cm high in 400 to 600 L/ha water (160-240 L/ac). Add a surfactant. Use only under pear trees established at least 10 years. Avoid contact with fruit, foliage or green bark with spray or drift.
paraquat GRAMOXONE (200g/L)	1.1 kg/ha 5.5 L/ha	 2.2 L/ac	Apply in 1000 L/ha water (400 L/ac) or apply 55 mL in 10 L water sprayed to wet weed foliage. Use on trees established one year or more.
paraquat GRAMOXONE (200g/L) plus napropamide DEVRINOL DF (50 DF)	1.1 kg/ha 5.5 L/ha 4.5 kg/ha 9 kg/ha	 2.2 L/ac 3.6 kg/ac	Add DEVRINOL to tank first then agitate and add GRAMOXONE. Apply in 1100 L/ha water (440 L/ac).
paraquat GRAMOXONE (200g/L) plus simazine PRINCEP NINE-T (90WG)	1.1 kg/ha 5.5 L/ha 2.25 to 4.5 kg/ha 2.5 to 5 kg/ha	 2.2 L/ac 1 to 2 kg/ac	This tank mix will provide knockdown of emerged weeds and residual control of germinating weeds. Apply in 1000 L/ha water (400 L/ac). Use only under trees established for at least one year.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)

Blueberries, Highbush

Recommended rates /ha or /ac refer to area actually treated with herbicide.

CULTURAL WEED CONTROL-SEE NOTES ON CULTURAL WEED CONTROL IN FRUIT & ORNAMENTALS SECTION.

A biodegradable mulch could be used for weed control within the plant row. Sawdust mulch will assist in weed control if it is applied early in the season before the weed seeds germinate. Apply old sawdust 5 cm thick. The mulch will not prevent the germination of weed seeds that may blow onto the surface of the mulch.

In subsequent years, the organic matter in the mulch may tie up and thus reduce the effectiveness of certain residual herbicides.

The nitrogen requirements of the crop will change as the mulch is degraded. Initially, nitrogen will be consumed by microorganisms, thus necessitating higher rates of nitrogen fertilizer. Later, as the sawdust is degrading, nitrogen will be released and the crop may require less nitrogen fertilizer than an unmulched crop. It may take 2 years or more for sawdust mulch to significantly decompose. Adjust fertilizer rates according to mulch breakdown, plant growth and leaf nutrient analysis results.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Simazine, napropamide and terbacil residues, high enough to harm many crops, may persist for several years after removal of orchard.

napropamide DEVRINOL DF (50 DF)	4.5 kg/ha 9 L/ha	 3.6 L/ac	Incorporation by rainfall or irrigation is essential. Apply once per season, either in the fall or spring, before weeds emerge. DO NOT apply to frozen ground.
fluazifop-p-butyl FUSILADE II (125g/L)	0.15 kg/ha 1.2 L/ha	 0.48 L/ac	Apply prebloom in the spring to actively growing annual grass at the 2-6 leaf stage.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply to actively growing quackgrass in the 3-5 leaf stage of growth.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac	Apply to emerged quackgrass up to the 3 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 2 L/ha	 0.45 L/ac 0.8 L/ac	Apply to emerged annual grasses in the 1-6 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application. Use the low rate for annual grasses and the high rate for volunteer grains.
clopyralid LONTREL 360 (360g/L)	0.15 to 0.3 kg/ha 0.42 to 0.83 L/ha	 0.17 to 0.33 L/ac	For control of emerged vetch and red and white clover. Make one application per year. Use lower rate for vetch and high rate for clover. The preharvest interval is 45 days.

glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	1 to 2 kg/ha 2.8 to 5.6 L/ha 2.8 to 5.6 L/ha 0.927 to 1.84 kg/ha 2.8 to 5.6 L/ha	 1.12 to 2.24 L/ac 1.12 to 2.24 L/ac 1.12 to 2.24 L/ac	Apply as a directed spray in 200 to 300 L/ha water (80-120 L/ac), using no more than 275 kPa pressure. Avoid contact with fruit, foliage or canes. Use only one application per season, no closer than 30 days to harvest.
[redacted]			
dichlobenil CASORON 4G (4 Gr)	7 to 9 kg/ha 175 to 225 kg/ha	 70 to 90 kg/ac	Apply to cool moist but unfrozen soil in late fall or spring before weeds emerge. If air temps are too warm (above 10-15 C) volatilization can occur causing plant injury. 70 g CASORON 4 G applied to an area 2 x 2 m is equivalent to 175 kg/ha (70 kg/ac). Use only under plants established for at least 3 years. DO NOT use on light, sandy soil.
napropamide DEVRINOL DF (50 DF)	4.5 kg/ha 9 kg/ha	 3.6 kg/ac	Incorporation by rainfall or irrigation is essential. Apply once per season, either in the fall or spring, before weeds emerge. DO NOT apply to frozen ground. DO NOT apply within 70 days of harvest.
simazine PRINCEP NINE-T (90WG) SIMAZINE 80W (80WP)	2.25 to 3.38 kg/ha 2.5 to 3.75 kg/ha 2.75 to 4.25 kg/ha	 1 to 1.5 kg/ac 1.1 to 1.7 kg/ac	Apply in 300 to 1000 L/ha water (120-400 L/ac) before weed emergence. Use only on established plants.
terbacil SINBAR (80 WP)	2.2 to 3.4 kg/ha 2.75 to 4.25 kg/ha	 1.1 to 1.7 kg/ac	Apply in 200 to 1000 L/ha water (80-400 L/ac). Use only in plantings established in the field for at least one year. Make one application per year. Injury may occur on sandy soil even with the low rate. Use the high rate only on muck or peat soils where experience has shown this to be a safe practice.
[redacted]			
fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	 0.4 L/ac	Apply to actively growing annual grasses in the 2-5 leaf stage of growth.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply to actively growing quackgrass in the 3-5 leaf stage of growth.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac	Apply to emerged annual grasses in the 1-6 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application. Use the low rate for annual grasses and the high rate for volunteer grains.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 2 L/ha	 0.45 L/ac 0.8 L/ac	Apply to emerged quackgrass up to the 3 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application.
[redacted]			

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
clopyralid LONTREL 360 (360g/L)	0.15 to 0.3 kg/ha 0.42 to 0.83 L/ha	 0.17 to 0.33 L/ac	Make one application per year. Use lower rate for vetch and high rate for clover. The preharvest interval is 45 days.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L) or glyphosate TMS TOUCHDOWN 480 (330g/L)	1 to 2 kg/ha 2.8 to 5.6 L/ha 2.8 to 5.6 L/ha 0.927 to 1.84 kg/ha 2.8 to 5.6 L/ha	 1.12 to 2.24 L/ac 1.12 to 2.24 L/ac 1.12 to 2.24 L/ac	Apply as a directed spray in 200 to 300 L/ha water (80-120 L/ac), using no more than 275 kPa pressure. Avoid contact with fruit, foliage or canes. Use only one application per season, no closer than 30 days to harvest.
paraquat GRAMOXONE (200g/L)	1.1 kg/ha 5.5 L/ha	 2.2 L/ac	Apply in 1000 L/ha water (400 L/ac) or apply 55 mL of product in 10 L of water sprayed to wet weed foliage. Use on plantings established one year.
paraquat GRAMOXONE (200g/L) plus simazine PRINCEP NINE-T (90WG)	1.1 kg/ha 5.5 L/ha 2.25 to 3.38 kg/ha 2.5 to 3.75 kg/ha	 2.2 L/ac 1 to 1.5 kg/ac	This tank mix will provide knockdown of emerged weeds and residual control of germinating weeds. Apply as a directed spray to established plantings. Use 1000 L/ha water (400 L/ac) to wet weed foliage.

Cranberries

Maintaining a healthy and vigorous crop will aid in weed control by avoiding openings in the bed for weed germination and establishment.

Prevent weeds from setting seed on dikes and in adjacent uncropped areas by using cultural or chemical weed control measures. Mowing at regular intervals will prevent many weeds from setting seed. Seeding the dikes with a desirable grass cover will reduce the opportunities for weed establishment and will provide bank stabilization.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

dichlobenil CASORON 4G (4 Gr)	4.4 kg/ha 110 kg/ha	 44 kg/ac	Controls annual broadleaf species, certain sedges and Juncus species. Apply in early spring, pre-bloom. Temporary reddening of plants may occur, especially with late spring applications. DO NOT use on new plantings or on newly sanded beds or on beds recently mowed for vines. Use lower rates of application on sandy bogs.
napropamide DEVRINOL 10G (10%)	4.5 to 6.7 kg/ha 45 to 67 L/ha	 18 to 26.8 L/ac	Do not use on new beds. Apply once per year in spring and irrigate immediately.
fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	 0.4 L/ac	Apply to actively growing annual grasses in the 2-5 leaf stage of growth.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	For non-bearing cranberries. Apply to actively growing quackgrass in the 3-5 leaf stage of growth. Use only one application per season.

sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha	0.13 to 0.19 L/ac	Apply to emerged annual grasses in the 1-6 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application. Use the low rate for annual grasses and the high rate for volunteer grains.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha 2 L/ha	 0.45 L/ac 0.8 L/ac	Apply to emerged quackgrass up to the 3 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application.
2,4-D 2,4-D AMINE 500 (470g/L)	0.47 kg/2L water 1 L/2 L water		Controls emerged annual and perennial weeds, including hardhack, St. John's Wort, Alder, Purple Aster. Use a 33 % solution with a ropewick or other wiper. Apply as an over the top application to actively growing weeds (June-July). Injury will result if crop is contacted. Use one application per year, no closer than 50 days before harvest.
clopyralid LONTREL 360 (360g/L)	7.2 g/L water 20 mL/L water		Controls emerged vetch. Apply this 2% solution with wiper-type equipment onto weed foliage that extends above the cranberry canopy. Wiper application may be made in the fall at least 2 weeks after harvest, after the vines have attained their winter dormancy colour. Spring applications can be made prior to bud-break, and again until growth is 1-2 mm long. Avoid contact with cranberry shoots after growth begins. Do not use more than 2 applications a year, no closer than 60 days to harvest.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.36 kg/4L of water 1 L/4L of water 1 L/4L of water		Use a 20% solution. Apply with a rope wick or other similar device. Refer to section on SELECTIVE WEED CONTROL WITH WIPER APPLICATORS. Avoid contact with the cranberry vines.

Currants and Gooseberries

Recommended rates /ha or /ac refer to area actually treated with herbicide.

Cultural Weed Control - See notes on CULTURAL WEED CONTROL IN FRUIT AND ORNAMENTAL CROPS section.

There are no herbicides registered for preemergence weed control in currants and gooseberries. A biodegradable mulch could be used for weed control in the planting strip. A straw mulch will assist in weed control within the row if it is applied early in the season before the weed seeds germinate. Use mulch that is free of weed seeds and ensure that enough nitrogen is provided for the crop.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

paraquat GRAMOXONE (200g/L)	1.1 kg/ha 5.5 L/ha	 2.2 L/ac	Apply in 1000 L/ha water (400 L/ac) or apply 55 mL of water as a spot treatment, sprayed to wet weed foliage. Direct the spray to wet the weeds but avoid wetting the leaves or green bark of the bushes.

Raspberries (Caneberries And Blackberries)

Recommended rates /ha or /ac refer to area actually treated with herbicide.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
PREPLANT - See under **PREPLANT - SITE PREPARATION** for details of products, rates and remarks.			
PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.			
napropamide DEVRINOL DF (50DF)	4.5 kg/ha 9 L/ha	 3.6 L/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. May be used on new or established plantings. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Avoid contact with fruit or foliage.
fluazifop-p-butyl FUSILADE II (125g/L)	0.15 kg/ha 1.2 L/ha	 0.48 L/ac	Apply to actively growing annual grasses in the 2-5 leaf stage of growth.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply to actively growing quackgrass in the 3-5 leaf stage of growth.
2,4-D * 2,4-D (470g/L)	0.55 kg/ha 1.2 L/ha	 0.48 L/ac	Use the amine formulation. Apply in 100 to 200 L/ha water (40-80 L/ac) actually sprayed. DO NOT spray when plants are in bloom. Keep spray off new shoots as much as possible. Spot spraying at a rate equivalent to 1 kg ai/ha (0.4 kg ai/ac) may be necessary to control established dandelions and other broadleaf weeds.
paraquat GRAMOXONE (200g/L)	1.1 kg/ha 5.5 L/ha	 2.2 L/ac	Apply in 1000 L/ha water (400 L/ac) or apply 55 mL in 10 L water sprayed to wet weed foliage. Direct spray at base of canes in the spring before new shoots emerge.
dichlobenil CASORON 4G (4 Gr)	7 kg/ha 175 kg/ha	 70 kg/ac	70 g CASORON 4 G applied to an area of 2x2m is equivalent to 175 kg/ha (70 kg/ac). Apply on established raspberry plantings in late fall. DO NOT cultivate or work into the soil. DO NOT APPLY IN THE SPRING as injury may result.
napropamide DEVRINOL DF (50 DF)	4.5 kg/ha 9 kg/ha	 3.6 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. May be used on new or established plantings. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Avoid contact with fruit or foliage.
simazine PRINCEP NINE-T (90WG) SIMADEX (500g/L) SIMAZINE 480 (480g/L)	1.8 to 2.25 kg/ha 2 to 2.5 kg/ha 3.6 to 4.5 L/ha 3.8 to 4.7 L/ha	 0.8 to 1 kg/ac 1.44 to 1.8 L/ac 1.52 to 1.88 L/ac	Apply in 300 to 1000 L/ha water (120-400 L/ac) actually sprayed. Apply as a directed spray early in the spring before the weeds emerge. Keep spray off young shoots. DO NOT use in first year plantings.

fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	 0.4 L/ac	Apply to actively growing annual grasses in the 2-5 leaf stage of growth.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply to actively growing quackgrass in the 3-5 leaf stage of growth.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.15 to 0.2 kg/ha 0.32 to 0.47 L/ha 2 L/ha	 0.13 to 0.19 L/ac 0.8 L/ac	Apply to emerged annual grasses in the 1-6 leaf stage during active growth. Complete grass control is normally obtained in 7 to 21 days after application. Use the low rate for annual grasses and the high rate for volunteer grains.
sethoxydim POAST ULTRA (450g/L) plus surfactant/solvent MERGE	0.5 kg/ha 1.1 L/ha	 0.45 L/ac	Apply to emerged quackgrass up to the 3 leaf stage during active growth. Complete grass control is normally obtained 7 to 21 days after application.
2,4-D * 2,4-D (470g/L)	0.55 kg/ha 1.2 L/ha	 0.48 L/ac	Use the amine formulation. Apply in 100 to 200 L/ha water (40-80 L/ac) actually sprayed. DO NOT spray when plants are in bloom. Keep spray off new shoots as much as possible. Spot spraying at a rate equivalent to 1 kg ai/ha (0.4 kg ai/ac) may be necessary to control established dandelions and other broadleaf weeds.
glufosinate ammonium IGNITE (150g/L)	1 kg/ha 6.67 L/ha	 2.7 L/ac	For use in the production year of raspberries grown in the biennial production system, or in a planting that will be removed after harvest. Do not apply to immature and weak plantings. Apply when shoots are 10 to 20 cm tall to suppress the emerged flush of primocanes, and control any weeds emerged at time of treatment. Apply in a minimum of 330 L water/ha (132 L/ac), avoiding drift onto green tissue of floricanes.
paraquat GRAMOXONE (200g/L)	1.1 kg/ha 5.5 L/ha	 2.2 L/ac	Apply in 1000 L/ha water (400 L/ac) or apply 55 mL in 10 L water sprayed to wet weed foliage. Direct spray at base of canes in the spring before new shoots emerge.
paraquat GRAMOXONE (200g/L) plus simazine PRINCEP NINE-T (90WG)	1.1 kg/ha 5.5 L/ha 1.8 to 2.25 kg/ha 2 to 2.5 kg/ha	 2.2 L/ac 0.8 to 1 kg/ac	This tank mix will provide knockdown of emerged weeds and residual control of germinating weeds on established plantings. DO NOT spray young raspberry shoots. Apply in 1000 L/ha water (400 L/ac) to wet weed foliage.

Notes:

Weed control ratings are given as 0-9 where 0 indicates no control and 9 indicates 90%-100% control under ideal conditions.

Ratings are subjective values based on best available information and give general comparisons based on use as descibed in this guide.

Under unfavorable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used.

Ratings in **BOLD** suggest the weed is listed on the product label for control or suppression.

Please see product label for more information on registered weed species, product uses and precautions.

Table 18. Fruit Crop Herbicide Weed Control Ratings

Trade Name	Active Ingredient	Crop Registration									Annual Grasses						Annual Broadleaves						Perennial Weeds																				
		apples	apricots	blackberries	cherries/plums	currants/gooseberries	grapes	highbush blueberries	peaches	pears	raspberries	barnyard grass	crabgrass	fall panicum	foxtail	old witch grass	sandbur	chickweed, common	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	bindweed, field	chickweed, mouse-eared	dandelion	goldenrod	grape, wild	ground-ivy (creeping-charlie)	mallow	milkweed	nightshade, climbing	nutsedge	plantains	poison-ivy	quackgrass	sow-thistle	stinging nettle	thistle, Canada	vetches	virginia creeper
Soil Applied Herbicides																																										
dichlobenil	CASORON	✓		✓	✓		✓	✓	✓	✓	✓	7	6	6	6	7	?	**8**	**7**	**8**	**3**	**8**	**4**	**7**	**7**	**7**	?	5	6	?	?	?	**7**	**7**	5	**7**	**7**	?	**7**	**7**	?
diuron	KARMEX						✓					9	**5**	5	**5**	8	?	9	9	**9**	9	**8**	**9**	?	?	5	?	?	?	?	5	?	5	?	?	5	5	?	5	?	?
linuron	LOROX, AFOLAN F, LINURON 480	✓			✓				✓	✓		**7**	**6**	5	**8**	**9**	?	**9**	**7**	**9**	**7**	**8**	**8**	5	8	?	?	?	?	?	5	?	8	?	?	7	8	?	7	?	?
metribuzin	LEXONE	✓	✓		✓[1]				✓			**7**	**8**	**9**	**8**	**9**	?	**9**	**9**	**9**	**9**	**8**	**8**	2	?	?	?	?	?	?	2	2	**2**	?	?	2	2	?	2	2	0
napropamide	DEVRINOL	✓		✓			✓	✓	✓	✓	✓	**8**	**9**	**8**	**8**	8	**8**	7	6	**8**	5	**8**	**7**	?	?	5	?	?	?	?	5	?	5	5	0	5	5	?	5	0	?
propyzamide	KERB	✓								✓		**8**	**7**	**8**	**8**	**9**	8	**9**	7	9	8	9	7	?	?	?	?	?	?	?	6	?	6	?	?	**6**	6	?	?	?	?
s-metolachlor	DUAL MAGNUM	✓	✓		✓				✓	✓		**9**	**9**	**8**	**9**	**9**	?	6	2	7	2	**8**	7	0	?	5	?	?	?	?	0	?	**8**	5	?	0	0	0	0	0	0
simazine	PRINCEP NINE-T, SIMADEX, SIMAZINE 480	✓	✓	✓			✓	✓	✓	✓	✓	**8**	**8**	6	**8**	8	?	8	9	**9**	9	9	**8**	2	?	5	?	?	?	?	0	?	5	?	?	6	5	?	5	0	?
terbacil	SINBAR	✓	✓[2]		✓[2]			✓	✓	✓[2]		**8**	**7**	8	**8**	8	5	9	7	**8**	**8**	**7**	**7**	6	8	6	?	?	?	?	6	?	6	8	?	6	0	?	6	0	?
trifluralin	TREFLAN	✓[2]	✓[2]	-	✓[2]	-	-	-	✓[2]	✓[2]	-	**9**	**9**	8	**8**	8	?	**7**	6	**8**	3	**8**	4	2	**?**	2	0	0	0	0	2	2	?	2	0	2	2	2	2	2	0
Soil Applied Herbicide Tank Mixes																																										
metolachlor + metribuzin	DUAL MAGNUM + LEXONE	✓	✓		✓				✓	✓		**9**	**9**	**9**	**9**	**9**	?	**9**	**9**	**9**	**9**	**8**	**8**	2	?	5	?	?	?	?	2	2	**8**	?	?	2	2	2	2	2	0
metolachlor + simazine	DUAL MAGNUM + PRINCEP NINE-T	✓	✓		✓				✓	✓		**9**	**9**	**9**	**9**	**9**	?	**9**	**9**	**9**	**9**	**8**	**8**	2	?	5	?	?	?	?	0	?	**8**	?	?	6	5	?	5	0	?
metribuzin + trifluralin	SENCOR + TREFLAN	✓[2]	✓[2]	-	✓[2]	-	-	-	✓[2]	✓[2]	-	**8**	**8**	**9**	**9**	**9**	?	**9**	**9**	**9**	**9**	**8**	**8**	2	**?**	2	0	0	0	0	2	2	**2**	2	0	2	2	2	2	2	0
napropamide + simazine	DEVRINOL + PRINCEP NINE-T	✓[2]	✓[2]	-	✓[2]	-	-	-	✓[2]	✓[2]	-	**8**	**9**	**8**	**8**	8	**8**	7	**9**	**9**	9	**9**	**8**	2	?	5	2	2	2	2	5	2	5	5	0	6	5	2	5	0	0
napropamide + terbacil	DEVRINOL + SINBAR	✓[2]	✓[2]	-	✓[2]	-	-	-	✓[2]	✓[2]	-	**8**	**9**	**8**	**8**	8	**8**	9	7	**8**	**8**	**8**	7	6	?	6	2	2	2	2	6	2	6	8	0	6	5	2	6	0	0
terbacil + metribuzin	SINBAR + LEXONE	✓	✓		✓[1]				✓	✓		**8**	**8**	**9**	**9**	**9**	?	**9**	**9**	**9**	**9**	**8**	**8**	?	8	6	2	2	2	2	6	2	6	8	2	6	2	2	6	2	0

Table 18. Fruit Crop Herbicide Weed Control Ratings

Crop Registrations

Treatment	Trade Name	apples	apricots	blackberries	cherries/plums	currants/gooseberries	grapes	highbush blueberries	peaches	pears	raspberries
postemergence grass herbicides											
fluazifop-p-butyl	FUSILADE II	✓	✓		✓			✓	✓	✓	✓
sethoxydim	POAST ULTRA	✓						✓	✓	✓	
postemergence broadleaf herbicides											
bentazon	BASAGRAN	✓[2]	✓[2]		✓[1,2]				✓[2]	✓[2]	
clopyralid	LONTREL	✓						✓			
2,4-D	2,4-D*			✓							✓
postemergence grass and broadleaf herbicides											
amitrole	AMITROL-T	✓									
glufosinate ammonium	IGNITE	✓			✓[3]		✓		✓	✓	
glyphosate	GLYPHOS, ROUNDUP, TOUCHDOWN	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
paraquat	GRAMOXONE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
paraquat + napropamide	GRAMOXONE + DEVRINOL	✓					✓		✓	✓	

Annual Grasses and **Annual Broadleaves**

Treatment	barnyard grass	crabgrass	fall panicum	foxtail	old witch grass	sandbur	chickweed, common	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed
postemergence grass herbicides												
fluazifop-p-butyl	9	9	9	9	9	?	0	0	0	0	0	0
sethoxydim	8	8	9	8	9	?	0	0	0	0	0	0
postemergence broadleaf herbicides												
bentazon	0	0	0	0	0	0	8	9	9	8	8	8
clopyralid	0	0	0	0	0	0	0	?	5	?	5	9
2,4-D	0	0	0	0	0	?	7	6	8	9	9	8
postemergence grass and broadleaf herbicides												
amitrole	?	?	8	?	?	?	7	6	6	?	5	?
glufosinate ammonium	9	9	9	9	9	?	9	9	9	8	9	9
glyphosate	9	9	9	9	9	?	9	9	9	9	9	9
paraquat	9	9	9	9	9	?	9	9	9	9	9	9
paraquat + napropamide	9	9	9	9	9	?	9	9	9	9	9	9

Perennial Weeds

Treatment	bindweed, field	chickweed, mouse-eared	dandelion	goldenrod	grape, wild	ground-ivy (creeping-charlie)	mallow	milkweed	nightshade, climbing	nutsedge	plantains	poison-ivy	quackgrass	sow-thistle	stinging nettle	thistle, Canada	vetches	virginia creeper
postemergence grass herbicides																		
fluazifop-p-butyl	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0
sethoxydim	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
postemergence broadleaf herbicides																		
bentazon	7	?	?	?	?	?	?	5	2	8	2	?	2	5	8[a]	6	5	?
clopyralid	0	0	8	?	?	0	0	0	?	0	0	0	0	8	?	9	9	?
2,4-D	5	2	8	2	5	2	2	2	?	2	8	?	2	6	?	8	5	?
postemergence grass and broadleaf herbicides																		
amitrole	?	?	9	?	2	?	?	8	?	8	?	8	8	8	6	8	8	?
glufosinate ammonium	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	5	9	8[a]	8[a]	8[a]	8[a]
glyphosate	8	9	8/9[b]	?	8	5	5	9	?	5	9	9	9	9	5	9	5[a]	8[a]
paraquat	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]
paraquat + napropamide	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]	8[a]

* Various formulations available, see Table 1.

? Insufficient information available to make a rating

✓ Indicates crop registration.

[1] For Cherries only.

[2] Non-bearing trees only.

[3] For Plums only.

[a] Top growth only; regrowth can be expected.

[b] use higher rates when larger than 15 cm tall or across

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
Strawberries - First (Planting) Year			
Recommended rates /ha or /ac refer to area actually treated with herbicide. Cultural Weed Control - See CULTURAL WEED CONTROL IN FRUIT AND ORNAMENTAL CROPS section. Use straw mulch which is free of weed seed in strawberries so that weeds are not imported into the crop. The mulch should be spread between the rows when it is pulled off the plants in the spring to provide additional weed control. **PREPLANT** - See under **PREPLANT - SITE PREPARATION** for details of products, rates and remarks. **PREEMERGENCE** - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall. Simazine, napropamide and terbacil residues, high enough to harm many crops, may persist for several years after removal of orchard.			
trifluralin TREFLAN (480g/L) RIVAL DF (60 DF) BONANZA 400 (400g/L)	0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1 to 1.9 kg/ha 1.5 to 2.75 L/ha	 0.5 to 0.96 L/ac 0.4 to 0.76 kg/ac 0.6 to 1.1 L/ac	Apply preemergence to the weeds or following a clean cultivation. Immediate incorporation in 2 directions is essential. May be applied and incorporated 1 day to 3 weeks before planting. May delay establishment under stressful conditions.
napropamide DEVRINOL DF (50 DF)	4.5 kg/ha 9 kg/ha	 3.6 kg/ac	Apply preemergent to weeds or following a cultivation. Incorporation by cultivation or rainfall or irrigation is essential. Where daughter plant establishment is important, (e.g., for plant producers) delay application until desired number of daughter plants have been established. Inhibition of daughter plant roots can occur where soil moisture is low and will be minimized if irrigation is applied shortly after application. See "Notes on Chemicals" section. Use only one application per season.
fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	 0.4 L/ac	Apply to actively growing annual grasses in the 2-5 leaf stage of growth. Use only one application per season. Wait at least 14 days after application before applying SINBAR.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply to actively growing quackgrass in the 3-5 leaf stage of growth.
2,4-D * 2,4-D (470g/L)	0.55 kg/ha 1.17 L/ha	 0.47 L/ac	Use the amine formulation. Apply in 100 to 200 L/ha of water (40-80 L/ac). Use low pressure and a coarse spray to minimize risk of spray drift to susceptible crops. DO NOT use while early runners are rooting, or between mid-August and fall dormancy when flower buds are developing for next year's crop.

glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.36 kg/2L 1 L/2L water 1 L/2L water		Use a 33% solution in a rope wick or other wiper. Refer to section on "Selective Weed Control With Wiper Applicators". Avoid contact with strawberry plants.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.36 to 0.72 kg/100L 1 to 2 L/100L water 1 to 2 L/100L water		Otherwise, a spot treatment with a 1-2% solution can be used, but crop in the treated area will be killed as well. DO NOT apply within 30 days before harvest.
4-6 Weeks After Planting (Soil Applied Grass and Broadleaf Herbicides)			
terbacil SINBAR (80 WP)	0.22 to 0.44 kg/ha 0.28 to 0.55 kg/ha	 0.11 to 0.22 kg/ac	Apply in at least 300 L/ha water (120 L/ac) when mother plants are well established but before runnering becomes extensive and new runner plants are rooting. Apply preemergence or early postemergence to the weeds. Use lower rate on sandy soils low in organic matter and on sensitive varieties such as Earlidawn, Midway, Micmac, Bounty and Kent, since they may be severely injured. This treatment may severely injure weak or diseased plants of any variety. Accurate calibration of sprayer is essential to avoid crop injury. DO NOT overlap spray swaths. Shallow cultivation can be done to train runners and control escaped weeds without destroying the effectiveness of terbacil.
4-6 Weeks After Planting (Postemergence Grass Herbicides)			
fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	 0.4 L/ac	Apply to actively growing annual grasses in the 2-5 leaf stage of growth. Use only one application per season. Wait at least 14 days after application before applying SINBAR.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply to actively growing quackgrass in the 3-5 leaf stage of growth. Use only one application per season. Wait at least 14 days after application before applying SINBAR.
4-6 Weeks After Planting (Postemergence Broadleaf Herbicides)			
2,4-D * 2,4-D (470g/L)	0.55 kg/ha 1.17 L/ha	 0.47 L/ac	Use the amine formulation. Apply in 100 to 200 L/ha of water (40-80 L/ac). Use low pressure and a coarse spray to minimize risk of spray drift to susceptible crops. DO NOT use while early runners are rooting, or between mid-August and fall dormancy when flower buds are developing for next year's crop.
4-6 Weeks After Planting (Postemergence Grass and Broadleaf Herbicides)			
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.36 kg/2L 1 L/2L water 1 L/2L water		Use a 33% solution in a rope wick or other wiper. Refer to section on "Selective Weed Control With Wiper Applicators". Avoid contact with strawberry plants.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.36 to 0.72 kg/100L 1 to 2 L/100L water 1 to 2 L/100L water		Otherwise, a spot treatment with a 1-2% solution can be used, but crop in the treated area will be killed as well. DO NOT apply within 30 days before harvest.
Late Summer/Fall(Labour Day) (Soil Applied Grass & Broadleaf Herbicides)			

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
napropamide DEVRINOL DF (50 DF)	4.5 kg/ha 9 kg/ha	 3.6 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply to a weed free soil surface. DO NOT apply during harvest period. DO NOT apply more than once per season.
terbacil SINBAR (80 WP)	0.144 to 0.22 kg/ha 0.18 to 0.28 kg/ha	 0.07 to 0.11 kg/ac	Apply in at least 300 L/ha water (120 L/ac), preemergence or early postemergence to the weeds. See remarks on terbacil above.
fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	 0.4 L/ac	Apply to actively growing annual grasses in the 2-5 leaf stage of growth. Use only one application per season. Wait at least 14 days after application before applying SINBAR.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply to actively growing quackgrass in the 3-5 leaf stage of growth.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.36 kg/2L 1 L/2L water 1 L/2L water		Use a 33% solution in a rope wick or other wiper. Refer to section on "Application Technology - Wiper Applicators". Avoid contact with strawberry plants.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.36 to 0.72 kg/100L 1 to 2 L/100L water 1 to 2 L/100L water		Spot treatments using this 1-2% solution will kill weeds and strawberry plants that are sprayed. Direct spray weeds only. DO NOT apply within 30 days before harvest.
napropamide DEVRINOL DF (50 DF)	4.5 kg/ha 9 kg/ha	 3.6 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply to a weed free soil surface just prior to mulching, but not on frozen ground. DO NOT apply more than once per season.
terbacil SINBAR (80 WP)	0.56 to 0.68 kg/ha 0.7 to 0.85 kg/ha	 0.28 to 0.34 kg/ac	Apply in at least 300 L/ha water (120 L/ac) just prior to mulching. Use low rate where it is planned to use terbacil again in the spring. See remarks on terbacil above.
Strawberry - Harvesting Year			
napropamide DEVRINOL DF (50DF)	4.5 kg/ha 9 kg/ha	 3.6 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply to a weed free soil surface just after mulch is removed, but not on frozen ground. DO NOT apply from bloom to harvest. DO NOT apply more than once per season.
terbacil SINBAR (80 WP)	0.22 to 0.28 kg/ha 0.28 to 0.35 kg/ha	 0.11 to 0.14 kg/ac	Apply in at least 300 L/ha water (120 L/ac) immediately after mulch is removed. If strawberry plants have made weak yellow growth under the mulch, wait 5-7 days until plants recover before applying terbacil. See remarks on terbacil above.

fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	0.4 L/ac	Apply to actively growing annual grasses in the 2-5 leaf stage of growth. Use only one application per season. Apply before bloom. Preharvest interval is 30 days. Wait at least 14 days after application before applying SINBAR.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	0.8 L/ac	Apply to actively growing quackgrass in the 3-5 leaf stage of growth. Use only one application per season. Apply before bloom. Preharvest interval is 30 days. Wait at least 14 days after application before applying SINBAR.
[illegible] Emergent Grass			
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.36 to 0.72 kg/100L 1 to 2 L/100L water 1 to 2 L/100L water		Spot treatments using this 1-2% solution will kill weeds and strawberry plants that are sprayed. Direct spray weeds only. DO NOT apply within 30 days before harvest.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.36 kg/2L 1 L/2L water 1 L/2L water		Use a 33% solution in a rope wick or other wiper. Refer to section on "Application Technology - Wiper Applicators". Avoid contact with strawberry plants. DO NOT apply within 30 days before harvest.
[illegible] and Broadleaf Herbicides			
terbacil SINBAR (80 WP)	0.56 to 0.68 kg/ha 0.7 to 0.85 kg/ha	0.28 to 0.34 kg/ac	Apply in at least 300 L/ha water (120 L/ac) preemergence or early postemergence to the weeds. If, 2,4-D was used prior to mowing, delay applying terbacil for at least 2 weeks. See remarks on terbacil above. DO NOT apply within 14 days of FUSILADE II.
[illegible] Grass Herbicides			
fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	0.4 L/ac	Apply to actively growing annual grasses in the 2-5 leaf stage of growth. Use only one application per season. Some annual grasses such as foxtail may not be controlled with this application to regrowth. DO NOT use within 14 days of SINBAR.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	0.8 L/ac	Apply to actively growing quackgrass in the 3-5 leaf stage of growth. Use only one application per season. Some annual grasses such as foxtail may not be controlled with this application to regrowth. DO NOT use within 14 days of SINBAR.
[illegible] Emergent Broadleaf [illegible]			
2,4-D * 2,4-D (470g/L)	1.034 kg/ha 2.2 L/ha	0.88 L/ac	Use amine formulation. Apply after harvest but before mowing to control dandelions and other broadleaf perennials. Delay mowing for a few days after application. DO NOT apply 2,4-D between mid August and fall dormancy because of its possible effect on flower bud formation. Veestar is more sensitive to 2,4-D than Redcoat.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
clopyralid LONTREL 360 (360g/L)	0.2 to 0.3 kg/ha 0.56 to 0.83 L/ha	 0.22 to 0.33 L/ac	To control tufted vetch, Canada thistle, sheep sorrel and ox-eye daisy. Apply with a boom sprayer in 150 to 250 L/ha of water (60-100 L/ac). Apply once per year as a single treatment immediately after harvest at renovation, 7-10 days before mowing on new and established plantings. Early cultivars like Veestar or Annapolis may be more susceptible to injury. Certain environment stresses such as drought, flooding or severe overwintering conditions may increase the risk of injury. Pre-harvest interval is 200 days.
Renovation (Postemergence Grass and Broadleaf Herbicides)			
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.36 kg/2L 1 L/2L water 1 L/2L water		Use a 33% solution in a rope wick or other wiper. Refer to section on "Application Technology - Wiper Applicators". Avoid contact with strawberry plants.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.36 to 0.72 kg/100L 1 to 2 L/100L water 1 to 2 L/100L water		Spot treatment using this 1-2% solution will kill weeds and strawberry plants in treated area. Direct spray to weeds only. DO NOT apply within 30 days before harvest.
Late Summer/Fall(Labour Day) (Soil Applied Grass & Broadleaf Herbicides)			
napropamide DEVRINOL DF (50 DF)	4.5 kg/ha 9 kg/ha	 3.6 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply to a weed free soil surface. DO NOT apply during harvest period. DO NOT apply more than once per season.
terbacil SINBAR (80 WP)	0.144 to 0.22 kg/ha 0.18 to 0.28 kg/ha	 0.07 to 0.11 kg/ac	Apply in at least 300 L/ha water (120 L/ac), preemergence or early postemergence to the weeds. See remarks on terbacil above.
Late Summer/Fall(Labour Day) (Postemergence Grass Herbicides)			
fluazifop-p-butyl FUSILADE II (125g/L)	0.125 kg/ha 1 L/ha	 0.4 L/ac	Apply to actively growing annual grasses in the 2-5 leaf stage of growth. Use only one application per season. Wait at least 14 days after application before applying SINBAR.
fluazifop-p-butyl FUSILADE II (125g/L)	0.25 kg/ha 2 L/ha	 0.8 L/ac	Apply to actively growing quackgrass in the 3-5 leaf stage of growth. Use only one application per season. Wait at least 14 days after application before applying SINBAR.
Late Summer/Fall(Labour Day) (Postemergent Grass & Broadleaf Herbicides)			
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.36 kg/2L 1 L/2L water 1 L/2L water		Use a 33% solution in a rope wick or other wiper. Refer to section on "Application Technology - Wiper Applicators". Avoid contact with strawberry plants.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.36 to 0.72 kg/100L 1 to 2 L/100L water 1 to 2 L/100L water		Spot treatments using this 1-2% solution will kill weeds and strawberry plants that are sprayed. Direct spray weeds only. DO NOT apply within 30 days before harvest.
Late Winter/Soil Applied Grass and Broadleaf Herbicides			

napropamide DEVRINOL DF (50 DF)	4.5 kg/ha 9 kg/ha	3.6 kg/ac	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply to a weed free soil surface just prior to mulching, but not on frozen ground. DO NOT apply more than once per season.
terbacil SINBAR (80 WP)	0.56 to 0.68 kg/ha 0.7 to 0.85 kg/ha	0.28 to 0.34 kg/ac	Apply in at least 300 L/ha water (120 L/ac) just prior to mulching. Use low rate where it is planned to use terbacil again in the spring. See remarks on terbacil above.

Notes:

Weed control ratings are given as 0-9 where 0 indicates no control and 9 indicates 90%-100% control under ideal conditions.

Ratings are subjective values based on best available information and give general comparisons based on use as descibed in this guide.

Under **unfavorable** conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used.

Ratings in **BOLD** suggest the weed is listed on the product label for control or suppression.

Please see product label for more information on registered weed species, product uses and precautions.

Table 19: Strawberry Herbicide Weed Control Ratings

		Annual Grasses						Annual Broadleaves									Perennial Weeds														
Treatment	Trade Name	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	volunteer grains	chickweed, common	groundsel	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	snapdragon, dwarf	violet, field (field pansy)	bindweeds	brome grass	chickweed, mouse-eared	daisy, ox-eye	dandelion	ground-ivy (creeping-charlie)	mallow	milkweed	nutsedge	plantains	poison-ivy	quackgrass	sorrel, sheep	sow-thistle	thistle, Canada	toadflax, yellow	vetches
Soil-applied grass and broadleaf herbicides																																
trifluralin	BONANZA, TREFLAN, RIVAL	**8**	**9**	8	**9**	8	9	8	3	7	**8**	3	**8**	4	?	?	0	?	5	0	0	0	0	0	9	0	0	0	0	0	0	0
napropamide	DEVRINOL	**8**	**9**	**8**	**8**	**8**	8	8	**8**	6	**8**	5	**8**	**6**	0	0	8	8	?	?	2	?	?	5	5	2	?	5	0	5	5	?	0
terbacil	SINBAR	**8**	**7**	8	**8**	8	8	**8**[a]	5	**7**[a]	**8**[a]	**8**[a]	**7**[a]	**7**[a]	2	**5**[a]	?	8	?	2	5	?	?	6	**6**	8	?	**6**	8	5	6	2	2
Post-emergent grass herbicide																																
fluazifop-p-butyl	FUSILADE II	**9**	**9**	**9**	**9**	**9**	9	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	**7**	0	0	0	0	0
Post-emergent broadleaf herbicides																																
2,4-D	2,4-D*	0	0	0	0	0	0	**7**	2	**6**	**8**	**9**	**7**	**8**	2	2	2	0	2	2	**8**	2	0	0	0	**8**	?	0	8	6	**8**	?	5
clopyralid	LONTREL 360	0	0	0	0	0	0	0	8	?	5	?	5	9	?	?	0	0	0	**8**	8	0	0	0	0	0	0	0	**9**	8[b]	**9**	0	**9**
Post-emergent grass and broadleaf herbicides																																
	GRAMOXONE	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**[b]	**8**[b]	**8**[b]	**8**[b]	**8**[b]	**8**[b]	**8**[b]	**8**[b]	**8**[b]	**8**[b]	**8**[b]	**8**[b]	**8**[b]	**8**[b]	**8**[b]	**8**[b]	**8**[b]
glyphosate	GLYPHOS, ROUNDUP, TOUCHDOWN [1]	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**8**	**9**	**9**	**8**	?	?	**7/8**	9	**9**	?	**8**	5	**5**	**9**	**8**	**9**	**9**	**8**	**8**	**9**	**9**	**8**	**5**[a]

* Various products are available, see Table 1.

? Insufficient information available to make a rating

[1] After harvest spot treatment only

[a] Low rates and single applications may provide less control.

[b] Top growth only; regrowth can be expected. Repeated treatments may provide control.

Herbaceous Ornamentals

To convert kg or L/ha to g or mL/100 m² multiply by 10 (example: 11 kg/ha becomes 110 g/100 m² and 28.4 L/ha becomes 284 mL/100 m²).

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

WARNING: Certain species may be injured by the following herbicides. Check manufacturer's directions for labeled species before use.

chlorpropham CIPC EC (480g/L) CIPC (20 Gr)	5.577 kg/ha 11.6 L/ha 27.5 kg/ha	 4.64 L/ac 11 kg/ac	May be applied either preemergence or postemergence to crop. When used postemergence apply as a directed spray or use the granular formulation. Particularly effective against purslane. Apply after a clean cultivation, when the soil is moist, in 200 to 400 L/ha (80-160 L/ac) water.
trifluralin TREFLAN (480g/L) RIVAL DF (60 DF) BONANZA 400 (400g/L)	0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1 to 1.92 kg/ha 1.5 to 2.75 L/ha	 0.5 to 0.96 L/ac 0.4 to 0.77 kg/ac 0.6 to 1.1 L/ac	Trifluralin must be incorporated before transplanting. DO NOT use for seeded annuals. Check label for list of tolerant species.
fluazifop-p-butyl FUSILADE II (125g/L)	0.075 to 0.25 kg/ha 0.6 to 2 L/ha	 0.24 to 0.8 L/ac	Use the higher rate (2 L/ha (0.8 L/ac) product) when quackgrass is present. Consult the label for list of tolerant species. Use as a directed application in sensitive species to avoid contact with leaves and green tissue.

Shelterbelts (Windbreaks) Established

Cultural Weed Control - See CULTURAL WEED CONTROL IN FRUIT AND ORNAMENTAL CROPS section.

dichlobenil CASORON 4G (4 Gr)	4.4 to 7 kg/ha 110 to 175 kg/ha	 44 to 70 kg/ac	Apply in early spring or late fall. Use the lower rate for spring application. Tolerant species include cedar, linden, maple, willow, caragana and ash. Reduce rates on lighter soils.
simazine PRINCEP NINE-T (90WG) SIMAZINE 480 (480g/L) or simazine SIMADEX (500g/L) or simazine SIMAZINE 80W (80WP)	2.25 to 3.37 kg/ha 2.5 to 3.75 kg/ha 4.7 to 7 L/ha 1.8 to 6.75 kg/ha 3.6 to 13.5 L/ha 4.4 to 6.6 kg/ha 5.5 to 8.25 kg/ha	 1 to 1.5 kg/ac 1.88 to 2.8 L/ac 1.44 to 5.4 L/ac 2.2 to 3.3 kg/ac	Apply in 500 L/ha (200 L/ac) water. Apply in the fall or spring prior to weed emergence or after emerged weeds have been removed. Windbreak species must be established for at least one year. Tolerant species include cedar, spruce, black walnut, white ash, green ash, elm, boxelder, maple and caragana. Check label for species which will tolerate higher rates of simazine. Apply before buds break in spring. Use low rate for sandy soils or low organic matter soils.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
trifluralin TREFLAN (480g/L) BONANZA 400 (400g/L)	0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1.5 to 2.75 L/ha	 0.5 to 0.96 L/ac 0.6 to 1.1 L/ac	Apply as a directed spray to the soil surface around the trees or shrubs. Incorporate as closely as possible to the trees and shrubs without causing damage to their roots.
fluazifop-p-butyl FUSILADE II (125g/L)	0.075 to 0.25 kg/ha 0.6 to 2 L/ha	 0.24 to 0.8 L/ac	Use the higher rate (2 L/ha (0.8 L/ac) product) when quackgrass is present.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.81 to 1.26 kg/ha 2.25 to 3.5 L/ha 2.25 to 3.5 L/ha	 0.9 to 1.4 L/ac 0.9 to 1.4 L/ac	Emerged annual weeds. Apply in 200 to 300 L/ha (80-120 L/ac) water. Apply to actively growing weeds as a directed spray. Remove all suckers from base of trunks before application. DO NOT allow spray or spray drift to contact leaves or green bark of trees. Use preemergence herbicide to provide residual control of weed seedlings (also see SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section). Applications may be made where the following species are grown: ash, caragana, cherry, elm, lilac, maple, mountain ash, poplar, Russian olive, willow, pine, spruce, fir or yew.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	1.71 to 2.52 kg/ha 4.75 to 7 L/ha 4.75 to 7 L/ha	 1.9 to 2.8 L/ac 1.9 to 2.8 L/ac	See remarks above. For quackgrass control, apply when grass has at least 3 to 4 new leaves.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	2.52 to 4.32 kg/ha 7 to 12 L/ha 7 to 12 L/ha	 2.8 to 4.8 L/ac 2.8 to 4.8 L/ac	See remarks above. Perennial weeds. Canada thistle should be at least in early bud, milkweed at bud and bindweed at full flower for best results.
paraquat GRAMOXONE (200g/L)	1.1 kg/ha 5.5 L/ha	 2.2 L/ac	Apply in 1000 L/ha (400 L/ac) water or apply 55 mL in 10 L of water sprayed to wet weed foliage. More than one treatment may be necessary during the season since paraquat leaves no residue on the soil.
paraquat GRAMOXONE (200g/L) plus simazine PRINCEP NINE-T (90WG)	1.1 kg/ha 5.5 L/ha 2.25 to 3.37 kg/ha 2.5 to 3.75 kg/ha	 2.2 L/ac 1 to 1.5 kg/ac	This tank mix will provide knockdown of emerged weeds and residual control of germinating weeds. Use only on crops established for at least one year. See precautions on paraquat and simazine below.

Shelterbelts (Windbreaks) Transplanted

PREPLANT - See under **PREPLANT - SITE PREPARATION** for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

trifluralin	0.6 to 1.155 kg/ha		Apply after a clean cultivation, and incorporate after application. Transplant the trees or shrubs so that most of their root system is placed below the treated layer of soil.
TREFLAN (480g/L)	1.25 to 2.4 L/ha	0.5 to 0.96 L/ac	
RIVAL DF (60 DF)	1 to 1.92 kg/ha	0.4 to 0.77 kg/ac	
BONANZA 400 (400g/L)	1.5 to 2.75 L/ha	0.6 to 1.1 L/ac	

fluazifop-p-butyl	0.075 to 0.25 kg/ha		Use the higher rate (2 L/ha product (0.8 L/ac)) when quackgrass is present.
FUSILADE II (125g/L)	0.6 to 2 L/ha	0.24 to 0.8 L/ac	

Turfgrass (Lawns, Parks, Golf Courses, and Sod Farms)

To convert kg or L/ha to g or mL/100m² multiply by 10 and change units (e.g., 11 kg/ha becomes 110 g/100m² and 28.4 L/ha becomes 284 mL/100m²).

The major species of broadleaf weeds infesting lawns in Ontario are dandelion, plantain, black medick, chickweed, prostrate knotweed, mallow, henbit, ground-ivy, and white clover. The major grassy weeds are crabgrass, annual bluegrass, quackgrass, orchard grass and bentgrass.

A weed free lawn can be maintained easily, cheaply, and with a minimum of effort, with an effective lawn maintenance strategy that encourages vigorous growth of a turfgrass, to keep lawn free of weeds. Most weeds cannot compete in a dense, healthy turf. Practices that encourage vigorous grass growth will discourage weed infestations. Proper irrigation and/or drainage, use of fertilizers, insect and disease control, and the use of the correct type of turfgrass will achieve this.

Mowing is beneficial because it stimulates bud development and tillering, inducing the sod to become thick and dense. Commonly grown grasses such as the fescues, bluegrasses and turf type perennial ryegrasses should be cut at a height of 4 to 6 cm. If grasses are cut shorter than this, invasion by weeds may occur. Avoid scalping the turf when cutting around trees and flower beds. Do not remove more than one-third of the leaf area when mowing. Mowing too frequently may reduce the carbohydrate reserves of the turf, thereby reducing its competitiveness. Mowing can also be used to remove annual weeds and eliminate seed production, reducing or preventing the spread of weeds.

Fertilizer is particularly important in establishing a thick, dense, and healthy turf sward. Too few nutrients applied to the sod will lead to increased susceptibility to disease and insects. The root system of the turf will not develop, so the grass cannot withstand traffic and recover from injury. Too much fertilizer may lead to soft, weak grass that is prone to disease damage.

Watering is particularly important during periods of drought that may injure, kill or induce dormancy in the turf, thereby allowing weeds to become established. Irrigation should be carried out at weekly intervals with about 3 cm of water per application to help produce deep rooted turf. Frequent light sprinkling will have the opposite effect on the grass roots. Light water applications encourage the germination and growth of shallow rooted species such as crabgrass and creeping bentgrass. Too much irrigation water will lead to infestations by yellow nutsedge and annual bluegrass. Therefore, it is important to install adequate drainage to ensure that waterlogging does not occur. Remember to provide adequate watering near trees and hedges because they compete for available moisture.

Compaction brought about by excessive traffic will often result in invasion by knotweed and annual bluegrass. Aeration practices will help in these situations but the best answer is to modify the area to reduce heavy traffic. Immediate resodding or reseeding of damaged areas will help to discourage weed infestations.

Use the best turfgrass species for a given situation. Fescues are tolerant to low light intensity in shaded areas under trees, whereas turf type perennial ryegrass varieties are quick to establish in newly seeded areas and will crowd out germinating weeds. Kentucky bluegrass, although slow to establish, is very competitive once established.

Provided weed populations are not too high, weeds can be removed by hand pulling or with a knife or V-shaped spudding tool. The reader is referred to other publications on these subjects from Agriculture and Agri-Food Canada and the Ontario Ministry of Agriculture Food, and Rural Affairs (see address located near the end of this publication).

Chemical weed control is often the easiest, most effective and cheapest way to control annual and perennial weeds when populations are very high. 2,4-D is most effective in the spring, or in September when the weeds are growing well. The treatment will generally thin clover in the lawns. Mecoprop, dichlorprop, and dicamba will control a number of weeds not normally controlled by 2,4-D. As with 2,4-D, a thorough wetting of the weed foliage is emphasized. Mecoprop, dichlorprop and dicamba are also sold in mixtures with 2,4-D. Mecoprop is generally safer to use on bentgrass than 2,4-D.

2,4-D will control many broadleaf weeds including dandelion, lamb's-quarters, mustards, peppergrass, pigweeds, plantains, shepherd's purse, smartweeds, vetch. Mecoprop will control many 2,4-D and MCPA tolerant weeds such as chickweeds, clovers, ground ivy and black medick. Dicamba will control broadleaf weeds including 2,4-D tolerant weeds such as chickweeds, clover and young knotweed but

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
will not adequately control plantain. MCPA will control field horsetail, dandelion, lamb's-quarters, mustards, plantains, shepherd's purse, wild carrot. More resistant weeds to MCPA include chickweeds, clovers and black medick. Two and three way mixes of these herbicides extend the spectrum of weeds that are controlled by only one of these herbicides. Mixtures containing dicamba should not be used close to shrubs, or other susceptible ornamentals, at rates above 0.425 kg/ha (active). Prepared mixtures of this chemical and 2,4-D are effective on a wide range of lawn weed species, including knotweed which is not controlled by most other herbicides except when very young. After seeding new turf, many annual weeds may emerge before the grass seedlings are up. If these young weeds are not controlled, they will shade and eventually crowd out much of the grass population. Mowing at a height of 6 to 8 cm will eliminate many such weeds. If they are extremely thick, 2,4-D at one-half the usual concentration (1.1 kg in 800 L water/ha) or mecoprop (1.1 kg in 400 L water/ha) can be used - but not before the grass had been up at least 4 weeks.			
When it is desired to establish turfgrass in areas that are heavily infested with weeds such as quackgrass, the areas should be treated with glyphosate (ROUNDUP) prior to the preparation of the seedbed.			
glyphosate ROUNDUP (356g/L) GLYFOS (360g/L) EXPEDITE GRASS & WEED (147g/L)	1.7 to 2.5 kg/ha 4.75 to 7 L/ha 4.75 to 7 L/ha 11.5 to 17 L/ha	 1.9 to 2.8 L/ac 1.9 to 2.8 L/ac 4.6 to 6.8 L/ac	Use in 200 to 300 L/ha (80-120 L/ac) water applied postemergence when quackgrass is actively growing and has at least four leaves. Allow 7 or more days after application before tillage. For maximum quackgrass control, a repeat treatment may be necessary before grass establishment. If retreatment is necessary, wait until quackgrass has reached the 3 to 4 leaf stage. For other perennial weeds, follow label instructions for proper rate and stage of growth.
Apply in 800-1000 L/ha (320-400 L/ac) water.			
bensulide BETASAN (480g/L) or BETASAN (GR) (12.5 Gr)	11 to 16.6 kg/ha 23 to 34.6 L/ha 88 to 132 kg/ha	 9.2 to 13.8 L/ac 35.2 to 52.8 kg/ac	Apply before crabgrass emergence in early spring, or in fall to established turf. Use the higher rate for fall application only if no reseeding has been done in the fall. For control of annual bluegrass apply at 13.7 to 16.6 kg/ha active (repeat applications may be required). Reseeding the area will not be possible for one year following treatment.
bentazon BASAGRAN (480g/L) plus oil concentrate ASSIST	0.84 kg/ha 1.75 L/ha 2 L/ha	 0.7 L/ac 0.8 L/ac	Top growth of yellow nutsedge is controlled by 2 applications 10 days apart.
dithiopyr DIMENSION (120g/L)	0.42 to 0.54 kg/ha 3.5 to 4.5 L/ha	 1.4 to 1.8 L/ac	Apply in established turf before crabgrass emergence or early postemergence when crabgrass is in the 1-3 leaf stage in 200-800 L/ha (80-160 L/ac) water. Use the low rate for preemergence applications. For control of crabgrass and many broadleaf weeds, dithiopyr may be tank mixed with various broadleaf herbicides.
fenoxaprop-p-ethyl ACCLAIM SUPER (80.5g/L)	0.092 kg/ha 1.14 L/ha	 0.46 L/ac	Apply as postemergent application for the control of crabgrass at the 1 leaf to 4 leaf plus 3 tiller in 400-800 L/ha (160-320 L/ac) water. Multi-tillered or heading grassy weeds may be sprayed and providing adequate coverage is attained, good efficacy will result. A second application may be required on mature monostands 21 days after first application. DO NOT apply to bentgrass or seedling Kentucky bluegrass. DO NOT tank mix with any other herbicide or pesticide. DO NOT spray a broadleaf herbicide 7 days prior to or 7 days after an application of ACCLAIM. DO NOT spray during periods of drought stress as poor control and possibly damage to desirable turf species may occur.

Apply in 200-400 L/ha (80-160 L/ac) water. Avoid contact with ornamentals and flowers. Avoid applying during hot, dry weather. DO NOT irrigate, rake, and/or mow until at least 24 hours after application. DO NOT apply to newly seeded lawns until after second mowing.			
2,4-D * 2,4-D (470g/L)	0.8 to 1.4 kg/ha 1.7 to 3 L/ha	 0.68 to 1.2 L/ac	Damage may occur when applied to bentgrass. If used on bentgrass apply at 0.28 kg/ha. Some yellowing of bentgrass may occur.
2,4-D * 2,4-D (470g/L) plus mecoprop MECOPROP (150g/L) or mecoprop/ 2,4-D MECOTURF PLUS 2,4-D ((1:1)400g/L) or mecoprop/ 2,4-D PREMIUM 2-WAY TURF HERBICIDE ((1:1)400g/L) or mecoprop/ 2,4-D MECOPROP PLUS 2,4-D ((0.9:1)194g/L)	0.85 to 1.1 kg/ha 1.81 to 2.34 L/ha 0.85 to 1.1 kg/ha 5.67 to 7.34 L/ha 1.7 to 2.2 kg/ha 4.25 to 5.5 L/ha 2 kg/ha 5 L/ha 2.14 kg/ha 11 L/ha	 0.72 to 0.93 L/ac 2.27 to 2.93 L/ac 1.7 to 2.2 L/ac 2 L/ac 4.4 L/ac	Damage may occur when applied to bentgrass. Provides broader spectrum weed control than 2,4-D or mecoprop applied alone. May be combined with DYCLEER (0.21 L/ha (0.08 L/ac)) for control of young knotweed.
2,4-D/ dicamba/ mecoprop KILLEX (308g/L) or PREMIUM 3-WAY TURF HERBICIDE (308g/L) or PAR III (308g/L)	1.7 kg/ha 5.5 L/ha 5.5 L/ha 5.5 L/ha	 2.2 L/ac 2.2 L/ac 2.2 L/ac	In closely mowed bentgrass (greens) it can be used only at half doses (30 mL/100 m²). Temporary yellowing of bentgrass may occur. Recovery from injury will occur one week after application (see precautions under dicamba).
dicamba DYCLEER (480g/L)	0.6 kg/ha 1.25 L/ha	 0.5 L/ac	DO NOT apply to bentgrass at 0.6 kg/ha but may be applied at lower doses or when mixed at lower doses with phenoxy herbicides. DO NOT apply near shallow rooted perennials because dicamba can be taken up by the roots of these plants. Pure dicamba is recommended for use in certain situations only; it is best when mixed at low use rates with phenoxy herbicides.
MCPA ESTEMINE MCPA (500g/L)	1.1 to 1.4 kg/ha 2.2 to 2.8 L/ha	 0.88 to 1.12 L/ac	DO NOT apply to bentgrass unless necessary, and then only at 0.28 kg/ha. Some yellowing of bentgrass may occur. MCPA can be used as a substitute for 2,4-D. At slightly higher doses than 2,4-D it will usually provide as good weed control as 2,4-D. Control of dandelion and plantain may not be as good as with 2,4-D during dry, hot weather.
mecoprop COMPITOX (150g/L) MECOPROP (150g/L)	0.83 to 1.28 kg/ha 5.5 to 8.5 L/ha 5.5 to 8.5 L/ha	 2.2 to 3.4 L/ac 2.2 to 3.4 L/ac	May be applied to bentgrass. Apply before flower to dandelion. Repeated applications may be required for complete control of dandelion and black medick.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER AGRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
mecoprop/ 2,4-D EXPEDITE BROADLEAF ((1:2)186g/L)	1.8 to 2.6 kg/ha 9.5 to 14 L/ha	 3.8 to 5.6 L/ac	EXPEDITE BROADLEAF herbicides are ready-to-use products which must be applied with the EXPEDITE APPLICATION SYSTEM.
The turf to be renovated should be mowed and thoroughly raked to remove all dead and cut vegetation.			
paraquat GRAMOXONE (200g/L) or	2 kg/ha 10 L/ha	 4 L/ac	Apply GRAMOXONE in 1,000 L/ha (400 L/ac) water. This treatment will "burn off" all emerged vegetation. When the old turf is dead, rotovate top 5 cm to cover dead grass, rake the surface to prepare seedbed and reseed.
glyphosate ROUNDUP (356g/L) GLYFOS (360g/L) EXPEDITE GRASS & WEED (147g/L)	1.7 to 2.5 kg/ha 4.75 to 7 L/ha 4.75 to 7 L/ha 11.5 to 17 L/ha	 1.9 to 2.8 L/ac 1.9 to 2.8 L/ac 4.6 to 6.8 L/ac	Apply ROUNDUP in 200 to 300 L/ha (80-120 L/ac) water or EXPEDITE GRASS & WEED after omitting at least one regular mowing. Tillage should be delayed 7 days after application to allow for proper translocation into underground plant parts. Direct seeding into the killed turf (no tillage) may be carried out.
Reduction in grass growth may be brought about by treatment with maleic hydrazide (Royal MH 60 SG, 6.5 to 8 kg/ha (2.6-3.2 kg/ac) product). Manufacturer's directions should be followed carefully. This chemical is recommended for use in areas where mowing and trimming are difficult and where a lawn like appearance is not necessary (see "Notes on Chemicals" section).			

Woody Nursery Stock - Field Grown Nursery Stock

Cultural Weed Control - See CULTURAL WEED CONTROL IN FRUIT AND ORNAMENTAL CROPS section.

Mechanical weed control such as cultivation and hand hoeing will provide weed control in sensitive species as well as provide control of weed escapes. Cultivators are available which will work in between trees and in the row.

Warning: Certain types of woody nursery stock may be injured by the following herbicides. Check manufacturer's directions for labeled species/cultivars before use.

PREPLANT - See under PREPLANT - SITE PREPARATION for details of products, rates and remarks.

PREPLANT INCORPORATED - Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE - Rainfall at 15 to 20 mm within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Preemergence/Preemergence Incorporated after planting. WARNING: Refer to manufacturers instructions for waiting period required after planting.

propyzamide KERB (50 WP)	1.5 kg/ha 3 kg/ha	 1.2 kg/ac	Apply in the late fall when the soil temperature is low but above freezing. Soil moisture should be high. This herbicide is absorbed through the roots.

s-metolachlor DUAL MAGNUM (915g/L)	1.14 to 1.6 kg/ha 1.25 to 1.75 L/ha	 0.5 to 0.7 L/ac	Apply in at least 150 L of water. Apply to soil prior to bud break of nursery stock. DO NOT apply within 4 weeks of bud burst or until the needles have hardened. For use on white spruce, Norway spruce, black spruce, white pine, Jack pine and red pine seedlings in their second year or older. Also for use on poplar stoolbeds. May have postemergent properties if applied to weeds before they reach the two-leaf stage.
isoxaben GALLERY (75 DF)	0.75 kg/ha 1 kg/ha	 0.4 kg/ac	For use in bareroot and container conifer seedlings. Applied prior to weed emergence in conifers, four or more weeds after crop germination and emergence. Rainfall or irrigation is needed to activate the herbicide. (Registered for use only by members of the Canadian Forest Nursery Weed Management Association).
chlorpropham CIPC (20 Gr)	6.8 to 11 kg/ha 34 to 55 kg/ha	 13.6 to 22 kg/ac	Apply the granular formulation after a clean cultivation when the soil is moist. CIPC should not be used on tree fruit nursery stock.
dichlobenil CASORON 4G (4 Gr)	4.4 to 7 kg/ha 110 to 175 kg/ha	 44 to 70 kg/ac	Apply in late fall or early spring. Use lower rate for spring application. DO NOT apply until 4 weeks after transplanting second year stock. Reduce rate on lighter soil.
napropamide DEVRINOL 50W (50 WP) DEVRINOL DF (50 DF) DEVRINOL 10G (10 Gr)	4.5 kg/ha 9 kg/ha 9 kg/ha 45 kg/ha	 3.6 kg/ac 3.6 kg/ac 18 kg/ac	Apply any time of the year to a clean cultivated soil surface or before weeds germinate. Use only once prior to or during a growing season. Napropamide must reach the zone of weed germination, either by mechanical incorporation or by adequate irrigation or precipitation. Shallow incorporation to a chemical depth of 2.5 to 5.0 cm or an irrigation with sufficient water to wet the soil to depth of 5 to 10 cm should occur within 7 days of a spring or fall application and within 2 days of a summer application. Fall applications will control weeds the following spring and summer. CAUTION: residues high enough to harm many crops may persist after repeated applications in perennial crops.
napropamide DEVRINOL 50W (50 WP) DEVRINOL DF (50 DF) plus simazine SIMAZINE 80W (80 WP)	4.5 kg/ha 9 kg/ha 9 kg/ha 1.1 kg/ha 1.37 kg/ha	 3.6 kg/ac 3.6 kg/ac 0.55 kg/ac	Apply before weeds emerge on established plantings only. Will provide additional control of broadleaved weeds. See remarks under napropamide and simazine.
simazine PRINCEP NINE-T (90WG) or simazine SIMAZINE 80W (80 WP) or simazine SIMADEX (500g/L)	2.25 to 3.4 kg/ha 2.5 to 3.75 kg/ha 2.2 to 3.4 kg/ha 2.75 to 4.25 kg/ha 1.8 to 6.75 kg/ha 3.6 to 13.5 L/ha	 1 to 1.5 kg/ac 1.1 to 1.7 kg/ac 1.44 to 5.4 L/ac	Apply before weeds emerge on established plantings only. Nursery stock can be injured by a residue in the soil if this herbicide is used where stock is removed and replaced with another planting. This herbicide cannot be used around ornamental shrubs if the area is to be under planted to ground cover or bedding plants. CAUTION: residues high enough to harm many crops may persist after repeated applications in perennial crops.
trifluralin TREFLAN EC (480g/L) RIVAL DF (60 DF)	0.6 to 1.155 kg/ha 1.25 to 2.4 L/ha 1 to 1.9 kg/ha	 0.5 to 0.96 L/ac 0.4 to 0.76 kg/ac	Must be incorporated immediately after application, after a clean cultivation. This treatment does not control ragweed, annual nightshade or mustards. Lady's-thumb may also escape the treatment.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
fluazifop-p-butyl FUSILADE II (125g/L)	0.075 to 0.25 kg/ha 0.6 to 2 L/ha	 0.24 to 0.8 L/ac	Use the higher rate (2 L/ha (0.8 L/ac)) when quackgrass is present. Consult the label for list of tolerant species. Use as a directed application in sensitive species to avoid contact with leaves and green tissue. Some blue junipers (e.g. 'Bar Harbour', 'Blue Acres', and 'Blue Rug') can be injured by over-the-top applications. CAUTION; THERE ARE DIFFERENCES BETWEEN CULTIVARS IN SENSITIVITY TO FUSILADE, e.g. Juniperus horizontalis 'Blue Acres' is sensitive while Juniperus horizontalis 'Plumosa Compacta' is tolerant. Test on samples of each cultivar not specifically listed on the label before using the herbicide or use as a directed application.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.81 to 1.26 kg/ha 2.25 to 3.5 L/ha 2.25 to 3.5 L/ha	 0.9 to 1.4 L/ac 0.9 to 1.4 L/ac	Apply to actively growing weeds. DO NOT allow spray contact with leaves or green bark of trees or shrubs (also see SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section).
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	1.71 to 4.32 kg/ha 4.75 to 12 L/ha 4.75 to 12 L/ha	 1.9 to 4.8 L/ac 1.9 to 4.8 L/ac	For the control of quackgrass, apply ROUNDUP TRANSORB at 4.75 to 7 L/ha (1.9-2.8 L/ac) when the quackgrass has at least 3 to 4 new leaves on each shoot. Canada thistle should be in the early bud stage, field bindweed in full flower and milkweed at the bud stage of growth. Use 7 to 12 L/ha (2.8-4.8 L/ac) in 200-400 L/ha (80-160 L/ac) water as a directed spray in established nursery plantings (also see SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section).
paraquat GRAMOXONE (200g/L)	1.1 kg/ha 5.5 L/ha	 2.2 L/ac	Use as a chemical mower. Can be used several times during the year. Direct spray to avoid the leaves or green bark of nursery plants. For spot treatments use 25 mL product in 4 L water.

Woody Nursery Stock: Container

CULTURAL WEED CONTROL

A successful weed control program must integrate cultural and chemical weed control practices.

Prepare the container bed area with a gravel layer and/or ground covers such as black plastic or opaque woven material. It is important that these surface covers exclude light in order to be effective in preventing weed seed germination. These ground covers can be used for a number of years before being replaced.

Keep the container beds and roadways free of weeds by physical removal or chemical mowing. Prevent weeds from setting seed in adjacent uncropped areas by using cultural or chemical weed control measures. Mowing at regular intervals will prevent many weeds from flowering. Try to control weed escapes before they set seed by cultural removal or chemical mowing. In some situations, such as along fences, tools such as a weed whip may be useful. Look for the source of weeds that disseminate into container areas such as poplars, willows, willowherb and Canada fleabane.

Control weeds around irrigation ponds so that small seeded weeds are not being sown into container stock with each watering. A vigorous grassed bank will help reduce weed infestations as well as providing bank stabilization. A filtering system in the irrigation line will remove weed seeds.

Removal of existing weeds from container stock before they flower MUST BE A PRIORITY JOB. Once a weed flowers it can disseminate hundreds of seeds by wind or by catapulting seeds. Many container weed species have several generations per year because their seeds do not need to overwinter before germinating. Remove and discard all pulled weeds well away from the growing area so that seeds are not disseminated into nearby containers.

Since many species of container weeds overwinter in the protected environment of a polyhouse, it is important to thoroughly weed container stock in the fall. Be sure to remove the rosettes of winter annuals such as shepherd's-purse and Canada fleabane and established plants and seedlings of common and mouse-eared chickweed. If not removed, these plants will be flowering by May or earlier.

dichlobenil CASORON 4G (4 Gr)	4.4 to 7 kg/ha 110 to 175 kg/ha	 44 to 70 kg/ac	Apply to bare soil before putting container pots on beds. Apply in spring when temperatures are cool and incorporate immediately with irrigation or mechanical incorporation. For the best results, apply to soil with more than 2% organic matter content. Use on gravel or sandy soils may result in inconsistent weed control. DO NOT cover polyhouses with plastic within one month after application and do not apply within plastic covered polyhouses or within greenhouse structures. Refer to label for tolerant species. DO NOT TRANSPLANT INTO TREATED SOIL FOR ONE YEAR.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	0.81 to 1.26 kg/ha 2.5 to 3.5 L/ha 2.5 to 3.5 L/ha	 1 to 1.4 L/ac 1 to 1.4 L/ac	Apply to actively growing weeds. DO NOT allow spray contact with leaves or green bark of trees or shrubs (also see SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section).
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	1.71 to 4.32 kg/ha 4.75 to 12 L/ha 4.75 to 12 L/ha	 1.9 to 4.8 L/ac 1.9 to 4.8 L/ac	For the control of quackgrass, apply ROUNDUP TRANSORB at 4.75 to 7 L/ha (1.9-2.8 L/ac) when the quackgrass has at least 3 to 4 new leaves on each shoot. Canada thistle should be in the early bud stage, field bindweed in full flower and milkweed at the bud stage of growth. Use 7 to 12 L/ha (2.8-4.8 L/ac) in 200 to 400 L/ha (80-160 L/ac) water as a directed spray. DO NOT allow spray contact with leaves or green bark of trees or shrubs (also see SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section).
paraquat GRAMOXONE (200g/L)	1.1 kg/ha 5.5 L/ha	 2.2 L/ac	Use as a chemical mower. Can be used several times during the year. Direct spray to avoid the leaves or green bark of nursery plants. For spot treatments use 25 mL product in 4 L water.

Woody Nursery Stock: Container Stock, Post Planting

To convert kg or L/ha to g or mL/100 m² multiply by 10 (example: 11 kg/ha becomes 110 g/110 m² and 28.4 L/ha becomes 284 mL/100 m²).

DO NOT apply herbicides within covered polyhouses, or within four weeks before covering. Certain types of container stock may be injured by the following herbicides. Check manufacturer's directions for labeled species/cultivars before use.

isoxaben GALLERY (75 DF)	0.75 kg/ha 1 kg/ha	 0.4 kg/ac	For use in bareroot and container conifer seedlings. Applied prior to weed emergence in conifers, four or more weeks after crop germination and emergence. Rainfall or irrigation is needed to activate the herbicide. (Registered for use only by members of the Canadian Forest Nursery Weed Management Association).
dichlobenil CASORON 4G (4 Gr)	4.4 kg/ha 110 kg/ha	 44 kg/ac	Apply at least 4 weeks after planting into containers to a weed free soil surface. DO NOT use after September 15 or within 30 days of covering treated stock in overwintering structures. Use only on containers growing outside. For use on these specific species: Juniperus chinensis, J. horizontalis and Thuja occidentalis

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
napropamide DEVRINOL 50W (50 WP) DEVRINOL DF (50 DF) DEVRINOL 10G (10 Gr)	4.5 kg/ha 9 kg/ha 9 kg/ha 45 kg/ha	 3.6 kg/ac 3.6 kg/ac 18 kg/ac	Apply at any time of the year to a weed free soil surface. May be applied to newly planted container stock after the potting media has settled from first watering. Incorporate by watering within 7 days of a spring or fall application and within 2 days of a summer application. Will not control bittercress.
oxadiazon RONSTAR 2G (2 Gr)	2 to 4.5 kg/ha 100 to 225 kg/ha	 40 to 90 kg/ac	Apply anytime during the year, prior to weed seed germination. Can be applied to both newly transplanted and established ornamentals and trees. DO NOT apply to wet foliage or under conditions in which granules will collect on leaves. Consult the label for list of tolerant species. Apply at least 4 weeks before covering polyhouses in fall.
simazine PRINCEP NINE-T (90WG) SIMAZINE 80W (80WP)	2.25 kg/ha 2.5 kg/ha 2.8 kg/ha	 1 kg/ac 1.12 kg/ac	Apply in 300 L/ha (120 L/ac) water. For use on juniper, white cedar and yew. Apply once per season, one month after planting. Apply prior to weed emergence; if weeds have emerged, remove them from the containers before application.
fluazifop-p-butyl FUSILADE II (125g/L)	0.075 to 0.25 kg/ha 0.6 to 2 L/ha	 0.24 to 0.8 L/ac	See notes under FIELD-GROWN NURSERY STOCK section. Consult the label for list of tolerant species. BE AWARE THAT THERE ARE DIFFERENCES BETWEEN CULTIVARS IN SENSITIVITY TO FUSILADE.

Notes:

Weed control ratings are given as 0-9 where 0 indicates no control and 9 indicates 90%-100% control under ideal conditions.

Ratings are subjective values based on best available information and give general comparisons based on use as descibed in this guide.

Under unfavorable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used.

Ratings in **BOLD** suggest the weed is listed on the product label for control or suppression.

Please see product label for more information on registered weed species, product uses and precautions.

Table 20. Nursery Herbicide Weed Control Ratings

		Annual Grass					Annual Broadleaves							Perennial Weeds																			
Treatment	**Trade Name**	barnyard grass	crabgrass	fall panicum	foxtail	old witch grass	chickweed, common	groundsel	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	bindweeds	brome grass	chickweed, mouse-eared	dandelion	grape, wild	ground-ivy (creeping-charlie)	horsetail	mallow	milkweed	nutsedge	plantains	poison-ivy	quackgrass	sow-thistle	stinging nettle	thistle, Canada	toadflax, yellow	vetches	virginia creeper
soil applied grass herbicides																																	
propyzamide	KERB	**8**	**7**	**8**	**8**	**8**	**7**	?	7	8	8	7	7	?	8	?	?	?	?	5	?	6	6	?	?	**6**	?	?	6	?	?	?
soil applied broadleaf herbicides																																	
isoxaben	GALLERY	?	?	?	?	?	?	?	?	**?**	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
soil applied grass and broadleaf herbicides																																	
chlorpropham	CIPC	8	9	7	8	7	?	?	8	7	5	7	5	?	7	?	?	?	?	5	?	?	?	?	?	5	5	?	5	?	?	?
dichlobenil	CASORON	7	**6**	6	**6**	7	**8**	**8**	**8**	**8**	**8**	**8**	8	**7**	5	7	**7**	5	6	**8**	?	?	**7**	**7**	?	**7**	**7**	?	**7**	?	**7**	?
napropamide	DEVRINOL	**8**	**9**	**8**	**8**	8	**7**	**7**	6	**8**	5	**8**	**7**	5	8	?	5	?	?	5	?	5	6	?	?	5	5	?	5	?	5	?
oxadiazon	RONSTAR 2G	**7**	**8**	?	**8**	?	5	**8**	?	**8**	8	**7**	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
s-metolachlor	DUAL MAGNUM	**9**	**9**	**9**	**9**	**9**	?	?	5	7	7	**7**	7	?	0	?	?	?	?	?	?	?	**9**	?	?	4	?	?	?	?	?	?
simazine	SIMADEX, SIMAZINE 480 or PRINCEP NINE-T	**8**	**7**	6	**8**	**8**	8	8	**9**	**9**	9	9	**8**	5	8	?	?	?	?	5	?	5	6	?	?	6	5	?	5	?	5	?
trifluralin	TREFLAN, BONANZA or RIVAL	**9**	**9**	8	**8**	8	**7**	5	6	**8**	3	**8**	4	4	**?**	**7**	?	?	?	4	?	5	5	?	?	4	5	?	5	?	5	?
postemergent grass herbicides																																	
fluazifop-p-butyl	FUSILADE II	**8**	**8**	**8**	**8**	**9**	0	0	0	0	0	0	0	?	8	3	3	3	3	?	3	?	?	3	3	**8**	?	3	?	3	3	3

Table 20. Nursery Herbicide Weed Control Ratings

Treatment	Trade Name	Annual Grass					Annual Broadleaves							Perennial Weeds																		
		barnyard grass	crabgrass	fall panicum	foxtail	old witch grass	chickweed, common	groundsel	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	bindweeds	brome grass	chickweed, mouse-eared	dandelion	grape, wild	ground-ivy (creeping-charlie)	horsestail	mallow	milkweed	nutsedge	plantains	poison-ivy	quackgrass	sow-thistle	stinging nettle	thistle, Canada	toadflax, yellow	vetches	virginia creeper
postemergent grass and broadleaf herbicides																																
glyphosate	GLYPHOS, ROUNDUP TRANSORB [1]	9	9	9	9	9	8	8	8	9	9	9	9	8	8	9	8/9[b]	8	5	5	5	8	8	9	9	9	8	5	9	5	5	8
paraquat	GRAMOXONE	8	8	8	8	8	8	8	8	8	8	8	8	5[a]	8	5[a]	5[a]	5[a]	5[a]	5[a]	5[a]	5[a]	5[a]	5[a]	5[a]	5[a]	5[a]	5[a]	5[a]	5[a]	5[a]	5[a]	5[a]

[1] Do not allow spray to contact green bark or leaves of crop

[a] Repeated treatments may provide control.

[b] use higher rates for weeds larger than 15 cm tall or across

? Insufficient information available to make a rating

Driveways, Patios And Paths

glyphosate CLEAR-IT (7g/L) ROUNDUP L & G (assorted)			These products are packaged in small quantities for the home garden trade. Use low pressure and a coarse spray to prevent drift onto lawns, flowers, vegetables and green leaves of desirable plants. Follow directions on label.
paraquat GRAMOXONE (200g/L)	0.6 to 1.1 kg/ha 3 to 5.5 L/ha in 275 L/ha water	1.2 to 2.2 L/ac in 110 L/ac water	This product is not available to the home gardener but can be used by nurserymen, landscape contractors and farmers. It should be applied as a directed spray to avoid wetting the leaves and green bark of shrubs, and other garden plants. For spot treatments use 30 mL of product in 10 L water per 100 m².
paraquat/ diquat WEED AND GRASS KILLER ((1:1)5 SG) WEED-BAN ((1:1)5 SG)			These products are packaged in small quantities for the home garden trade. The granules are readily dissolved in water so that application can be made with a watering can or garden sprayer. It is used as a "chemical mower". Use low pressure and a coarse spray to prevent drift onto lawns, flowers, vegetables and green leaves of other desirable plants. (See note above). Follow directions on label.

Seedbeds And Potting Soil

To convert kg or L/ha to g or mL/100 m² multiply by 10 (example 11 kg/ha becomes 110 g/100 m² and 28.4 L/ha becomes 248 ml/100 m²).

dazomet BASAMID (98 Gr)	500 kg/ha 510 kg/ha	 204 kg/ac	See "Notes on Chemicals" section. Refer to manufacturer's directions for specific details as well as direction on sealing soil, evacuating gases and performing the safety germination test. DO NOT use below 6°C.
metam sodium VAPAM (380g/L)	3.8 kg/100 m² 10 L/100 m² in 800 L water		Apply as a drench to a soil that should be wet to a depth of at least 8 cm. DO NOT plant for 10 to 14 days or longer if the weather is cool.
methyl bromide/ chloropicrin TERR-O-GAS 67 (67 Li)			A poisonous gas which must be applied under a gas proof cover (usually plastic). Its use is subject to the Pesticides Act. It may be used by the grower on his own seedbeds but he must obtain a permit from the Ontario Ministry of the Environment each time it is used. The manufacturer's instructions must be followed, and the seedbed or greenhouse aired thoroughly after the treatment period. If there is any question, the safety precautions in the Pesticides Act should be studied, or inquiry made at the local office of the Ontario Ministry of Agriculture, Food and Rural Affairs or the Ontario Ministry of the Environment. Follow manufacturer's directions.
methyl isothiocyanate/ dichloropropene VORLEX PLUS ((203g + 373g)/L)	32 to 259 kg/ha 55 to 450 L/ha	 22 to 180 L/ac	A liquid soil fumigant which is injected into the prepared seedbed by means of special applicators.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
methyl isothiocyanate/ dichloropropene/ chloropicrin	40 to 323 kg/ha		Chloropicrin provides additional disease control to the mixture.
VORLEX PLUS CP ((185g + 370g + 163g)/L)	55 to 450 L/ha	22 to 180 L/ac	

Roadsides, Rights-Of-Ways, Fencerows And Non-crop Areas

In agricultural areas, weeds growing in fencerows, around buildings and on roadsides are sources of potential weed infestation to other parts of a farm. In addition, brush and weeds around fields harbor insects, diseases and other pests that may be detrimental to farming operations. Shrubs like wild cherry may be possible sources of livestock poisoning. Farmers may also wish to reclaim land on which willows or brush have encroached.

It is important to keep drainage ditches and farm ponds free of troublesome aquatic vegetation.

Road maintenance personnel are interested in controlling weeds and brush to reduce the cost of winter snow removal programs. Low vegetation will also give the road user clear view of other vehicles, animals, children and other hazards. It is important to prevent brush encroachment onto the roadway proper, to keep the drainage ditches open to prevent flooding and to minimize the fire hazard of tall, dry vegetation in the late summer. A grass cover also prevents soil erosion much better than weeds.

Both railway and power supply authorities are concerned with maintaining safe and accessible rights-of-way by controlling growth of weeds and brush.

In certain areas (beneath guide rails, in storage yards, under railway tracks and under fences at road intersections), it may be advantageous to completely kill all vegetation for a longer period of time. Chemicals and suggestions for their use in this way are presented in the section on LONG TERM TOTAL VEGETATION CONTROL.

In roadside and right-of-way spraying, for weed control or brush control, precautions should always be taken to minimize herbicide drift. It is advisable to inspect or monitor each roadside just prior to spraying to locate susceptible crops, water crossings and other sensitive areas. Appropriate "shut off" and "turn on" points should be marked so these areas can be avoided during the actual spray operation.

Brush Control

There are several techniques that may be used for the chemical control of deciduous woody species: stem foliage sprays, basal bark sprays and frilling or spot treatments. The choice of technique will depend on such factors as brush type, accessibility, availability of equipment, proximity to susceptible crops or ornamental vegetation and the size of the control program.

Stem Foliage Treatments Applied to "Runoff" - Most deciduous woody species

Stem foliage treatment of brush should be limited to smaller growth (less than 2 m in height). Treatments should be applied to thoroughly wet the stems and foliage to the point of runoff. This technique is most effective just after full leaf development in late spring or early summer.

The choice of chemicals for controlling stands of deciduous brush should be based on the susceptibilities of the predominant species (Table 19) or whether the brush to be controlled is near homes, recreational areas, etc.

2,4-D *	1.7 to 4.2 kg/1000L	One application may be sufficient for sensitive species. For intermediately sensitive species, repeated
2,4-D (470 g/L)	3.6 to 9 L/1000L	treatments are normally required.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
dicamba DYCLEER (480g/L) plus 2,4-D * 2,4-D (470g/L)	1.9 kg/1000L 4 L/1000L 3.8 kg/1000L 8 L/1000L		Apply to the point of runoff when the leaves are fully expanded.
dicamba DYCLEER (480g/L) plus dichlorprop/ 2,4-D DIPHENOPROP BK 700 (679g/L)	2.5 kg/1000L 5.2 L/1000L 4.9 kg/1000L 7.15 L/1000L		White ash, sugar maple. Follow instructions on DYCLEER label and prepare as a tank mix. Apply to the point of runoff when leaves are fully expanded.
dichlorprop/ 2,4-D DIPHENOPROP BK 700 (679g/L) ESTAPROP (582g/L) DICHLORPROP D (582g/L)	5.1 to 6.8 kg/1000L 7.5 to 10 L/1000L 8.75 to 11.7 L/1000L 8.75 to 11.7 L/1000L		Apply the LOW-VOLATILE ESTER in areas dominated by species expected to be tolerant to 2,4-D alone.
fosamine ammonium KRENITE (480g/L)	4.81 to 7.21 kg/1000L 10 to 15 L/1000L		Oak, maple, alder, hickory and ash. Additional surfactants may be required for difficult species. Follow manufacturer's directions
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	3.6 to 7.2 kg/1000L 10 to 20 L/1000L 10 to 20 L/1000L		Most woody and herbaceous species. Can be applied during June, July or August.
picloram/ 2,4-D TORDON 101 ((1:3.7)305g/L)	3.05 kg/1000L 10 L/1000L		Excluding white ash. Apply to wet the stems and foliage to the point of runoff when the leaves are fully expanded. A PERMIT FOR PURCHASE AND USE IS REQUIRED. (See "Notes on Chemicals" section).
triclopyr GARLON 4 (480g/L)	1.92 to 3.84 kg/1000L 4 to 8 L/1000L		Apply to the point of run-off when the brush is actively growing. Use the higher rate for the more difficult species (See Table 19, follow manufacturer's directions).
For Brush Control on Roadsides and other Rights-of-Way			
dicamba DYCLEER (480g/L) plus 2,4-D * 2,4-D (470g/L)	2 kg/ha 4.2 L/ha 3.8 kg/ha 8 L/ha	 1.7 L/ac 3.2 L/ac	Apply in sufficient water (220 to 330 L/ha) (88 to 132 L/ac) to wet all foliage. Amine or ester formulations of 2,4-D may be used.
dicamba DYCLEER (480g/L) plus dichlorprop/ 2,4-D DIPHENOPROP BK 700 (679g/L)	2.5 kg/ha 5.2 L/ha 4.9 kg/ha 7.2 L/ha	 2.1 L/ac 2.9 L/ac	Apply in sufficient water (200 to 330 L/ha) (80 to 132 L/ac) to wet all foliage.

dichlorprop/ 2,4-D DIPHENOPROP BK 700 (679g/L) ESTAPROP (582g/L) DICHLORPROP D (582g/L)	3.8 to 10.2 kg/ha 5.5 to 15 L/ha 6.5 to 17.5 L/ha 6.5 to 17.5 L/ha	 2.2 to 6 L/ac 2.6 to 7 L/ac 2.6 to 7 L/ac	Apply in 750 to 1500 L/ha water (300 to 600 L/ac) during periods of active growth. Rate of mixture depends on brush density or height.
imazapyr ARSENAL (240g/L)	0.72 kg/ha 3 L/ha	 1.2 L/ac	Maple, poplar, raspberry, wildrose. Apply in sufficient water (100-550 L/ha) (40 - 220 L/ac) to wet all foliage during periods of active growth (see Notes on Chemicals).
picloram/ 2,4-D TORDON 101 ((1:3.7)305g/L)	5.49 to 7.62 kg/ha 18 to 25 L/ha	 7.2 to 10 L/ac	Apply in 450 L/ha water (180 L/ac) during the active growing season. Use an approved drift control system or additive. A PERMIT FOR PURCHASE AND USE IS REQUIRED. (See "Notes on Chemicals" section).
triclopyr GARLON 4 (480g/L)	1.92 to 3.84 kg/ha 4 to 8 L/ha	 1.6 to 3.2 L/ac	Apply this LOW VOLATILE ESTER in a minimum of 200 L/ha water (80 L/ac) during periods of active growth.

The BASAL-BARK treatment is useful on a wide range of trees and brush with a trunk diameter up to about 15 cm. The chemical is applied so as to thoroughly cover the basal 30 cm of the trunk and any exposed roots. For oak, hickory, basswood or ash, treatments are most effective from February to June. Most other species may be treated at any season of the year.

Light, simple equipment, coupled with the possibility of winter operations when labor is cheaper and access to swampy areas possible, give this treatment an important role in a brush control program.

2,4-D * 2,4-D (470 g/L)	3 kg/100L 6.4 L/100L	Hawthorn. Use the LOW-VOLATILE ESTER formulations in fuel oil.
dichlorprop/ 2,4-D DIPHENOPROP BK 700 (679g/L) ESTAPROP (582g/L) or dichlorprop/ 2,4-D DICHLORPROP D (582g/L)	1.9 to 3 kg/100L 2.8 to 4.4 L/100L 3.2 to 5.2 L/100L 1.35 kg/100L 2.3 L/100L	Most woody species, including conifers. Use the LOW-VOLATILE ESTER formulations in fuel oil. Spray bark to wet only.
triclopyr GARLON 4 (480g/L)	9.6 to 14.4 kg/100L 20 to 30 L/100L	Hawthorn. ONE SIDED LOW VOLUME - This low volume treatment can be applied to stems less than 15 cm in diameter. Apply the spray to thoroughly wet at least one side of the stem and root crown but not to the point of run-off. STREAMLINE - Apply sufficient spray to one side of stems less than 8 cm in basal diameter to form a band that is 5 cm in width. The treatment zone should widen to encircle the stem within 30 minutes. Treat both sides of stems which are 8 to 12 cm in basal diameter.

In many cases, it is more desirable to remove existing brush by hand than to spray it and leave the dead material standing. Chemical stump treatment is particularly useful in preventing the vigorous regrowth that is the characteristic response of many deciduous species after cutting. Moreover killing the stump is the first step towards encouraging it to rot. Most treatments must be applied to freshly cut stumps to achieve maximum effectiveness. For old stumps, it is best to drill several holes or to split stump with a wedge before applying the treatments. Regrowth from an old stump should be sprayed along with the stump. Various dye materials may be added to the oil based sprays to assure that all exposed surfaces of the stumps are treated. (See application Indicators)

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
2,4-D * 2,4-D (470 g/L)	2 kg/100L 4.25 L/100L		Apply in oil as a carrier.
dichlorprop/ 2,4-D DIPHENOPROP BK 700 (679g/L) ESTAPROP (582g/L) DICHLORPROP D (582g/L)	1.9 kg/100L 2.8 L/100L 3.25 L/100L 3.25 L/100L		Apply in oil as a carrier.
dichlorprop/ 2,4-D WEEDONE CB (160g/L)	1.4 kg/100L 8.75 L/100L		Apply undiluted product to all exposed surfaces. Stumps need not be treated immediately after cutting, thus separate cutting and spraying operations are possible.
picloram/ 2,4-D TORDON 101 ((1:3.7)305g/L)	3.05 kg/10L 10 L/10L		Dilute 1 to 1 with water or 1 to 1 with ethylene glycol if below freezing. A PERMIT FOR PURCHASE AND USE IS REQUIRED.
triclopyr GARLON 4 (480g/L)	9.6 to 14.4 kg/100L 20 to 30 L/100L		Apply in oil as a carrier to cut stump. Thoroughly wet all cut surfaces and any exposed bark. Treatment can be performed any time after mechanical removal.
Evergreen or Conifer Control			
All of the treatments are applied so as to thoroughly wet all foliage. Use low pressure and apply from 500 to 1500 L/ha solution (200 to 600 L/ac), depending on the amount of foliage. Thorough coverage is particularly important and the addition of a wetting agent will increase effectiveness.			
dicamba DYCLEER (480g/L) dichlorprop/ 2,4-D DIPHENOPROP BK 700 (679g/L)	2.5 kg/1000L 5.2 L/1000L 4.9 kg/1000L 7.15 L/1000L		Apply in spring or early summer. Thorough coverage is needed. Follow instructions on DYCLEER label for tank mix.
dicamba DYCLEER (480g/L) plus 2,4-D 2,4-D (470g/L)	1.9 kg/1000L 4 L/1000L 3.8 kg/1000L 8 L/1000L		Apply as AMINES in early summer. Thorough coverage is needed.
paraquat GRAMOXONE (200g/L)	1 kg/1000L 5 L/1000L		Spruce, balsam, pine. Apply in spring or early summer. Thorough coverage is needed. This treatment can be combined with 2,4-D, dichlorprop treatments that are recommended for the species of deciduous brush present (Table 19).
picloram/ 2,4-D TORDON 101 ((1:3.7)305g/L)	3.05 kg/1000L 10 L/1000L		Apply when the conifers are actively growing in early summer. Spray should thoroughly wet all plant parts including stem, foliage, and root collar. Use an approved drift control system or additive. A PERMIT IS REQUIRED FOR PURCHASE AND USE. (See "Notes on Chemicals" section).
picloram/ 2,4-D TORDON 101 ((1:3.7)305g/L)	5.49 to 7.62 kg/ha 18 to 25 L/ha	7.2 to 10 L/ac	Apply in 450 L/ha (180 L/ac) water as a constant volume foliar application during the period of active conifer growth in early summer. Use an approved drift control system or additive. A PERMIT FOR PURCHASE AND USE IS REQUIRED. (See "Notes on Chemicals" section).

General Treatments for Woody Species

Single or scattered trees or shrubs may be controlled efficiently with dry applications of sodium borate or chlorate mixtures. Apply the chemical in a band at the base of the plant, following the manufacturer's directions.

On stands of deciduous or coniferous brush that range from light to scattered, use individual spot treatment with bromacil (HYVAR X-L). It may be applied with an exact delivery hand gun. Apply undiluted at 10 g per metre of height (5 cm diameter) or brush or dilute 1 L HYVAR X-L with 5 L of water and apply 60 g per metre of height of brush. Taller and larger brush requires progressively more herbicide.

Many trees sprout prolifically after they have been pruned. The application of fortified tree wound dressings to the surface of the cuts can reduce the number of new sprouts from many tree species.

These paints improve natural inhibition achieved through the use of poor trimming practice. All pruning should be done to strong laterals. Severe pruning should be avoided.

Best results will be obtained if the materials are applied to the cuts between April 15 to July 15. Treatment of all cuts is important, as each is a potential location for sprouting from both dormant and adventitious buds. Cover the entire cut and about 2 cm of the surrounding bark, especially below the cut. Heavy tree wound dressing will adversely affect the rate of callus formulation of some species.

Alpha naphthalene acetic acid, ethyl ester (THREHOLD), as a 1% surface tree wound dressing or aerosol can be effective on willow, poplar, maple, oak, elm, basswood, apple and possibly other species.

Glyphosate as a 0.15 g EZJECT capsule can be used to control woody brush and trees with an EZJECT capsule injection system. Capsules must penetrate through the outer bark and into the inner living tissue to provide effective results. Capsules should be spaced evenly around the tree, below all major branches at a rate of 1 capsule per 5 cm stem diameter at breast height (dbh). Stems should be in excess of 3 cm dbh but usually not in excess of 20 cm dbh. Trees should not be frozen at time of treatment. Allow 1 to 2 years for complete control.

Perennial Weed Control (Non Crop Land)

CAUTION: Unless otherwise recommended, these treatments should not be used in crop situations. Their use should also be avoided if the chemical is likely to wash or leach into areas occupied by the roots of desirable trees or other plants. Precautions should also be followed to avoid spray drift onto non target vegetation.

The use of atrazine, simazine, bromacil, or diuron non selectively, as described, is generally limited by cost to the handling of small patches of perennial weeds. The chemical either leaches down to the weed root system or makes the surface soil toxic for a period of time varying from a few months to several years, depending on the chemical, rate of application and soil type. Generally, crops cannot be grown successfully until the effect of the chemical has disappeared. Corn, however, can be grown safely when high rates of simazine and atrazine are applied.

Some perennial weeds, such as field bindweed, horsetail, goldenrod, milkweed and bracken fern, are difficult to eradicate at the lower rates of diuron, simazine, atrazine and bromacil. Follow the manufacturer's directions carefully if the area is to be re-seeded. The amitrole treatment is of value in spot treating patches of quackgrass in a field that is not entirely infested.

While the tops of many perennial weeds may be controlled by doses of 2,4-D that may be selectively used in resistant crops, heavier doses, as described, must be used if eradication is to be attempted. Several applications upon successive stages of regrowth will probably be necessary. Generally, treatments with 2,4-D during rapid development of the weed at about the early bud to flowering stages of growth are most effective. Spray should be applied to thoroughly wet all foliage.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section)
Heavier doses of 2,4-D on patches of weeds may be applied during normal selective spraying operations merely by slowing down the sprayer speed in the infested areas. Local crop damage should be expected where this is done.			
Perennial weeds are more difficult to control than annual weeds because regrowth occurs rapidly from underground parts after the top growth is removed by chemical or mechanical means. In non crop land they pose a special problem because cultivation cannot be used for their control. Chemicals must kill the root system as well as the above ground parts to give effective perennial weed control.			
amitrole AMITROL 240 (231g/L)	3 to 4 kg/ha 12.5 to 16.5 L/ha	 5 to 6.6 L/ac	Apply to actively growing quackgrass foliage when growth is 15 to 20 cm in height. Wait at least 10 days before plowing or disking. With amitrole, most field crops can be planted safely 2 to 3 weeks after applying the chemical.
glyphosate ROUNDUP TRANSORB (360 g/L) GLYFOS (360g/L)	0.85 to 0.9 kg/ha 2.35 to 2.5 L/ha 2.35 to 2.5 L/ha	 0.94 to 1 L/ac 0.94 to 1 L/ac	For a minimum of one season control of quackgrass, apply in the fall or spring before planting. Apply, using flat-fan nozzles, in 50 to 100 L/ha water (20 - 40 L/ac). For use in higher water volumes, the addition of a surfactant such as ENHANCE or LI 700 is recommended. Refer to "Notes on Chemicals" and product labels for registered rates of glyphosate, surfactants and appropriate water volumes.
propyzamide KERB (50 WP)	1.1 to 1.8 kg/ha 2.2 to 3.6 kg/ha	 0.88 to 1.44 kg/ac	Apply in fall from late September to early November but before soil freezes. Control of weeds other than perennial grasses cannot be expected.
2,4-D * 2,4-D (470g/L)	1 to 2 kg/ha 2 to 4.25 L/ha	 0.85 to 1.7 L/ac	Apply in 1000 L/ha water (400 L/ac). See Table 21 for list of weed susceptibilities to 2,4-D and related chemicals.
amitrole AMITROL 240 (231g/L)	4.5 to 6.75 kg/ha 18.75 to 28 L/ha	 7.5 to 11.2 L/ac	Milkweed. Apply in 500 to 1000 L/ha water (200 to 400 L/ac) after most shoots have emerged but before flowering.
chlorsulfuron TELAR (75 DF)	90 g/ha 120 g/ha	 48 g/ac	Including Canada thistle, dandelion, field horsetail. A surfactant should be added to improve control. Follow manufacturer's directions.
clopyralid TRANSLINE (360g/L)	0.15 to 0.3 kg/ha 0.42 to 0.83 L/ha	 0.17 to 0.33 L/ac	Including coltsfoot, spotted knapweed, ragweed, Canada thistle, ox-eye daisy, tufted vetch, scentless chamomile and clover.. Apply as a broadcast in 200 L/ha water (80 L/ac) or in sufficient water to ensure thorough coverage of target vegetation. Treat when weeds are young and actively growing. For coltsfoot, treatments should be performed prior to August. (See Notes on Chemicals).
dicamba DYCLEER (480g/L)	1.108 kg/ha 2.3 L/ha	 0.92 L/ac	Field bindweed, leafy spurge and cypress spurge. Apply sprays in mid June or during flowering, in 100 to 200 L/ha water (40 to 80 L/ac). Canada thistle or perennial sow thistle. Apply spray in late spring just prior to flowering, or apply to regrowth escaping other treatments, in summer or fall.
dichlorprop/ 2,4-D DIPHENOPROP BK 700 (679g/L) ESTAPROP (582g/L) DICHLORPROP D (582g/L)	2.375 kg/ha 3.5 L/ha 4 L/ha 4 L/ha	 1.4 L/ac 1.6 L/ac 1.6 L/ac	Apply as the LOW-VOLATILE ESTER in 200 to 600 L/ha water (80 to 240 L/ac) during the month of May or in early fall.
triclopyr GARLON 4 (480g/L)	0.48 to 1.92 kg/ha 1 to 4 L/ha	 0.4 to 1.6 L/ac	Apply in a minimum of 200 L/ha water (80 L/ac) to ensure uniform coverage.

bromacil HYVAR X-L (240g/L)	7.2 to 10.8 kg/ha 30 to 45 L/ha	 12 to 18 L/ac	
bromacil/ diuron KROVAR ((1:1)80 DF)	10.8 to 14.4 kg/ha 13.5 to 18 kg/ha	 5.4 to 7.2 kg/ac	
dichlobenil CASORON 4G (4 Gr)	11 to 22 kg/ha 275 to 550 kg/ha	 110 to 220 kg/ac	To use as a split application, apply CASORON 4G at 150 kg/ha (60 kg/ac) in the fall and again at 150 kg/ha (60 kg/ac) in early spring.
diuron KARMEX (80 DF)	11.2 to 44 kg/ha 14 to 55 kg/ha	 5.6 to 22 kg/ac	Apply in 1000 L/ha water (400 L/ac).
glyphosate ROUNDUP TRANSORB (360 g/L) GLYFOS (360g/L)	2.52 to 4.32 kg/ha 7 to 12 L/ha 7 to 12 L/ha	 2.8 to 4.8 L/ac 2.8 to 4.8 L/ac	Apply 200 to 300 L/ha water (80 to 120 L/ac) when field bindweed has reached full flower, and Canada thistle and milkweed have reached the bud to bloom stage.
imazapyr ARSENAL (240g/L)	0.72 kg/ha 3 L/ha	 1.2 L/ac	Apply in sufficient water (100-550 L/ha or 40-220 L/ac) to wet all foliage during periods of active growth.(See Notes on Chemicals).
picloram/ 2,4-D TORDON 101 ((1:3.7)305g/L)	2.134 kg/ha 7 L/ha	 2.8 L/ac	Apply in 200 L/ha water (80 L/ac) during spring or early summer after growth appears. Use an approved drift control additive or system. A PERMIT IS REQUIRED FOR PURCHASE AND USE (see "Notes on Chemicals" section).

Poison-ivy Control

Several chemicals have been shown to be effective for the control of poison-ivy. However, some growth may occur after treatment with any of these chemicals and retreatments will be necessary to achieve eradication. The chemical treatment of poison-ivy must take into account the location in which the weed is growing. If desirable shrubs or trees are present, soil sterilants should be avoided, and the other materials used with caution.

A 9 to 14 L sprayer is the most convenient method of applying herbicides to patches of poison-ivy. Thorough coverage of the leaves with the spray is essential for maximum effect. After spraying, the area should be left alone until the plants die, at which time the dead stems should be gathered up and buried. Even at this stage care should be taken as poisoning may be brought about by handling the dead plant. All treatments are most effective when the poison-ivy is in full leaf and growing actively, from about June 15 to July 31.

amitrole AMITROL 240 (231g/L)	2.25 kg/ha 9.25 L/ha	 3.7 L/ac	Apply in at least 1000 L/ha water (400 L/ac) when plants are actively growing. Thoroughly wet all foliage.
dicamba DYCLEER (480g/L) plus 2,4-D * 2,4-D (470g/L)	0.82 kg/ha 1.7 L/ha 1.1 kg/ha 2.2 L/ha	 0.68 L/ac 0.88 L/ac	Apply in at least 560 L/ha water (224 L/ac).

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see "Notes on Chemicals" section.)
dichlorprop/ 2,4-D DIPHENOPROP BK 700 (679g/L) ESTAPROP (582g/L) DICHLORPROP D (582g/L)	6.8 kg/1000L 10 L/1000L 11.7 L/1000L 11.7 L/1000L		Apply spray until foliage is thoroughly wet.
glyphosate ROUNDUP TRANSORB (360g/L) GLYFOS (360g/L)	2.52 to 4.32 kg/ha 7 to 12 L/ha 7 to 12 L/ha	 2.8 to 4.8 L/ac 2.8 to 4.8 L/ac	Apply to actively growing plants in 200 to 300 L/ha water (80 to 120 L/ac) to thoroughly wet the foliage but do not spray to the point of runoff.
imazapyr ARSENAL (240g/L)	0.72 kg/ha 3 L/ha	 1.2 L/ac	Apply in sufficient water (100-550 L/ha (40-220 L/ac)) to wet all foliage during periods of active growth (see Notes on Chemicals).
triclopyr GARLON 4 (480g/L)	1.92 to 2.88 kg/ha 4 to 6 L/ha	 1.6 to 2.4 L/ac	Use a minimum of 200 L/ha (80 L/ac) of spray solution to ensure thorough coverage.

Reduction Of Herbicidal Drift

In the application of herbicides, especially of the hormone type (2,4-D, mecoprop, dichlorprop, dicamba, etc.) sensitive crops (grapes, tomatoes, turnips, tobacco, beans, carrots, beets, fruit trees, ornamental plants and many others) beyond the area being sprayed can be damaged by vapor or spray drift. To reduce the danger of herbicidal drift:

1. Use only amine formulations when it is necessary to apply phenoxy herbicides (2,4-D, mecoprop, dichlorprop, etc.) near sensitive non target plants.

2. Very slight spray drift with herbicides containing dicamba can be more damaging to soybeans and other crops than equivalent amounts of 2,4-D spray drift. There is also a possibility of dicamba vapor drift from treated plant foliage during high temperatures (in excess of 25°C); thus, use of dicamba containing herbicides should be avoided near sensitive, desirable plants.

3. Use the lowest pressure possible to apply the herbicide. This may mean the use of a dribble bar, Radiarc boom, vibrajet nozzle, Directa-spra nozzle, flood jet or more conventional nozzle tips.

4. Manufacturer's recommendations regarding nozzle spacing and height should be carefully followed. It may be necessary to mount nozzles on skids to keep them at a constant distance from the surface to be sprayed.

5. For roadside spraying various spray additives (i.e. NALCO-TROL or 38-F) are available which may reduce spray drift by increasing the viscosity or density of the spray. These materials should be used following manufacturer's directions and observing normal precautions (vehicle speed, wind velocity, proximity to sensitive crops, etc.).

WARNING: These methods and materials can reduce but not eliminate herbicidal drift. In areas near sensitive crops, all normal precautions must be taken. It should be emphasized that extremely low, even invisible, amounts of spray drift can be very damaging to sensitive crops. In some cases, spraying during the growing season should not be considered.

Roadside Weed Control

The main objectives of a weed control program for roadsides are: (1) to control tall growing weeds so that mowing costs can be minimized; (2) to control weeds that may infest adjacent land by wind dispersal of seed; (3) to maintain an attractive grass cover that will minimize erosion problems; (4) to prevent buildup of excessive vegetation that can become a fire hazard in the late summer or complicate snow removal in winter; and most importantly, (5) to ensure highway safety. Most broadleaf weeds are susceptible to early summer applications of 2,4-D and related herbicides (Classification of Weeds According to Response to Various Foliage Sprays Table). However, many weeds are not effectively controlled by 2,4-D mixtures and these resistant weeds can become an increasing problem unless other herbicides are used. The use of spot treatments with non selective chemicals that may temporarily injure the grass may be justified in some cases to control isolated, but dense, patches of difficult weeds before they spread and become a problem over a large area.

2,4-D *	1.1 kg/ha		Apply as the AMINE or LOW-VOLATILE ESTER in 200 to 300 L/ha water (80 to 120 L/ac) in early summer. See Table 21 for weed susceptibilities for 2,4-D mixtures.
chlorsulfuron TELAR (75 DF)	53 g/ha 75 g/ha	 30 g/ac	A surfactant should be added to improve control. Follow manufacturer's directions.
clopyralid TRANSLINE (360g/L)	0.15 to 0.3 kg/ha 0.42 to 0.83 L/ha	 0.17 to 0.33 L/ac	Canada thistle, perennial sow thistle, spotted knapweed and coltsfoot. Apply as a broadcast foliar in 200 L/ha water (80 L/ac) or in sufficient water to ensure thorough coverage of target vegetation. For spot treatment apply in 800 L and spray weeds to the point of run-off. Treat when weeds are young and actively growing. For coltsfoot, treatments should be performed prior to August. (See Notes on Chemicals).
dicamba DYCLEER (480g/L)	0.6 kg/ha 1.25 L/ha	 0.5 L/ac	Leafy and cypress spurge. Apply when weed is actively growing in 100 to 200 L/ha water (40 to 80 L/ac).
dicamba DYCLEER (480g/L)	1.1 kg/ha 2.3 L/ha	 0.9 L/ac	Goldenrod. Apply when weed is actively growing in 100 to 200 L/ha water (40 to 80 L/ac). Field bindweed. Apply in mid June or when flowering.
dicamba DYCLEER (480g/L)	1.36 kg/ha 2.83 L/ha	 1.13 L/ac	Canada thistle, perennial sow-thistle. Apply sprays in late spring just prior to flowering or apply to regrowth escaping other treatments in summer or fall.
dichlorprop/ 2,4-D DIPHENOPROP BK 700 (679g/L) ESTAPROP (582g/L) DICHLORPROP D (582g/L)	2.375 kg/ha 3.5 L/ha 4 L/ha 4 L/ha	 1.4 L/ac 1.6 L/ac 1.6 L/ac	Apply as the LOW-VOLATILE ESTER in 200 to 500 L/ha water (80 to 200 L/ac) during early summer for most species.
picloram/ 2,4-D TORDON 101 ((1:3.7)305g/L)	2.14 kg/ha 7 L/ha	 2.8 L/ac	Apply in 200 L/ha water (80 L/ac) during the spring or early summer after growth appears. Use an approved drift control additive or system. A PERMIT FOR PURCHASE AND USE IS REQUIRED (see "Notes on Chemicals" section).
triclopyr GARLON 4 (480g/L)	0.48 to 1.92 kg/ha 1 to 4 L/ha	 0.4 to 1.6 L/ac	Apply in 200 to 300 L/ha water (80 to 120 L/ac) when weeds are actively growing.
amitrole AMITROL 240 (231g/L)	3 to 4 kg/ha 12.5 to 16.5 L/ha	 5 to 6.6 L/ac	Canada thistle, perennial sow-thistle. Apply to the point of runoff when the thistles are in the head stage of growth. Use spot treatments only, since grasses are susceptible to this chemical and may be controlled for up to one season.
amitrole AMITROL 240 (231g/L)	4.5 to 6.75 kg/ha 18.75 to 28 L/ha	 7.5 to 11.2 L/ac	Milkweed. Spray to wet in early summer before flowering. Use spot treatments only, since grasses are susceptible to this chemical and may be controlled for up to one season. Horsetail, toadflax, quackgrass. Spray when horsetail is growing vigorously.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section.)
glyphosate	2.52 to 4.32 kg/ha		Milkweed, field bindweed, Canada thistle, perennial sow-thistle. Apply in 200 to 300 L/ha water (80 to 120 L/ac) when the weeds are in the bud to full flower stage. Use spot treatments only, since grasses are susceptible to this chemical and may be controlled for up to one season. Also see, SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section.
ROUNDUP TRANSORB (360 g/L)	7 to 12 L/ha	2.8 to 4.8 L/ac	
GLYFOS (360g/L)	7 to 12 L/ha	2.8 to 4.8 L/ac	

Vegetation Control-Long Term Non Selective

CAUTION: These chemicals should not be used to treat areas that are close to gardens, desirable trees, etc. Since these chemicals are non-selective (will kill any plant that they contact), special care must be used in their application. If the area (for example, a driveway) is higher than a nearby lawn, the chemical may wash onto the lawn with the first rain. If trees or shrubs are feeding under the treated areas, the chemical may leach to their roots and cause injury.

It may be desirable to maintain certain areas completely free of vegetation. Usually two problems are involved. First, the existing vegetation must be destroyed, including the destruction of underground stems and roots of perennials. Second, the bare area thus produced must be maintained either by persistent soil active chemicals or by foliage treatment of weed seedlings.

Some chemicals will kill existing vegetation. Others, while excellent for maintaining the bare area, may be used more economically if combined with another chemical to kill existing growth. If a mixed population of weeds is present, combinations of chemicals that will kill the different weed types may be used advantageously.

Uniform coverage with all chemicals is essential. Touch up operations should be expected, as a single treatment will seldom give complete eradication.

It is usually found that two applications of the lower recommended rate (i.e., 5.5 to 11 kg/ha), depending on the chemical used, spaced 6 to 12 months apart, give better results than one single application of the higher recommended rate. This approach also reduces the risk of off-site movement.

The length of weed control obtained will depend on several factors which include rainfall, soil type, weed type and amount of chemical applied. Control is usually maintained longer in heavier soil types, while in sandy soils and gravel areas the length of effective control is much less.

Care should be exercised when selecting a chemical to use on driveways because washing of the chemical onto nearby lawns and gardens may occur. In situations where this may occur it is advisable to use one of the chemicals listed under SHORT TERM TOTAL VEGETATION CONTROL or DRIVEWAYS AND PATIOS.

bromacil HYVAR X-L (240g/L)	6.16 to 10.8 kg/ha 25.7 to 45 L/ha	 10.3 to 18 L/ac	Mullein is not adequately controlled by bromacil.
bromacil/ 2,4-D CALMIX PELLETS (3 PE)	20 to 40 kg/ha 250 to 500 kg/ha	 100 to 200 kg/ac	Use higher rate for the more dense infestations of weeds.
bromacil/ diuron KROVAR ((1:1)80 DF)	10.8 to 14.4 kg/ha 13.5 to 18 kg/ha	 5.4 to 7.2 kg/ac	
diuron KARMEX (80 DF)	11.2 to 44 kg/ha 14 to 55 kg/ha	 5.6 to 22 kg/ac	Plantain is not adequately controlled by diuron.
hexazinone VELPAR (90 SP)	4.05 to 8.1 kg/ha 4.5 to 9 kg/ha	 1.8 to 3.6 kg/ac	
imazapyr ARSENAL (240g/L)	0.72 kg/ha 3 L/ha	 1.2 L/ac	Apply in sufficient water (100-550 L/ha (40-220 L/ac)) to wet all foliage during periods of active growth (see Notes on Chemicals).

Vegetation Control-Short Term Non-selective

Chemicals offer an alternative to mowing in areas where top kill of low growing vegetation is desired. The chemicals listed below are first applied when the growth is about 15 cm high. Spray to runoff. Tall vegetation is more difficult to kill and can become an unsightly fire hazard when it dies.

amitrole AMITROL 240 (231g/L) or glyphosate ROUNDUP TRANSORB (360 g/L) GLYFOS (360g/L)	4 kg/ha 16.5 L/ha 1.8 to 2.52 kg/ha 5 to 7 L/ha 5 to 7 L/ha	 6.6 L/ac 2 to 2.8 L/ac 2 to 2.8 L/ac	Amitrole, AMITROL 240, or glyphosate must be applied to actively growing foliage to be effective. Apply in sufficient water (200 to 400 L/ha (80-160 L/ac)) to thoroughly wet all foliage. With AMITROL 240, newly formed leaves turn white before the plants die. The appearance of foliage injury may be delayed during cool conditions. Regrowth may occur from freshly germinating plants or from underground portions of perennial weeds. (Also see, SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section.)
paraquat GRAMOXONE (200g/L) or diquat REGLONE (200g/L)	1.1 to 2.2 kg/ha 5.5 to 11 L/ha 0.55 to 1.1 kg/ha 2.75 to 5.5 L/ha	 2.2 to 4.4 L/ac 1.1 to 2.2 L/ac	Diquat or paraquat should be used at the higher rates and in a high spray volume (1000 L/ha (400 L/ac)) for dense weed growth. For chemical mowing along roadsides and other areas where a scorch is desired, paraquat at 1.1. kg/ha will be adequate. Use 1 L/1000L of AGRAL 90 as a wetting agent for best results.

Weed Control In Ditches

When ditches on roadsides, or in other locations, contain standing or moving water, herbicides should not be applied to emergent weeds without consulting the Ontario Ministry of the Environment regarding the need for a permit (see WATER WEEDS section). However, such permits are not normally necessary for the application of herbicides to control weeds adjacent to ditches or weeds in ditches when no water is present. But the following precautions should be taken:

1. Spray when ditch or stream contains no flowing water.

2. Avoid spraying directly onto water surface (violation of Pesticides Act, Water Resources Act).

3. Schedule spray programs so that extensive sections of stream bank or ditch bank are not sprayed at one time.

4. Work upstream rather than downstream along the stream bank or ditch bank.

5. Ascertain downstream water uses to avoid possible conflict with the rights of other landowners.

2,4-D *	2.25 kg/ha		Bulrushes. Apply as the LOW-VOLATILE ESTER in 750-1000 L/ha (300-400 L/ac) water.
amitrole AMITROL 240 (231g/L)	9 to 11 kg/ha 37.5 to 45.75 L/ha	 15 to 18.3 L/ac	Cattails. Apply in a minimum of 1000 L/ha (400 L/ac) water from the time that the cattails are formed until frost.
glyphosate ROUNDUP TRANSORB (360 g/L)	2.52 to 4.32 kg/ha 7 to 12 L/ha	 2.8 to 4.8 L/ac	Cattails. Apply during mid to late flowering stage (mid July to late August) when cattails are actively growing. For isolated spots use a 1% solution (1 L product in 100 L water) and spray to wet all foliage but not to the point of runoff.
paraquat GRAMOXONE (200g/L)	1.1 to 2.2 kg/ha 5.5 to 11 L/ha	 2.2 to 4.4 L/ac	Bulrushes. Apply in 750 to 1000 L/ha (300-400 L/ac) water when the seed heads are forming - usually late July or August.

Table 21. Susceptibility of Woody Plants to Various Herbicides and Mixtures as Foliage Spray

Common Name	2,4-D	2,4-D Dichlorprop (1:1)	2,4-D Dicamba (2:1)	Fosamine ammonium	2,4-D Picloram (3.7:1)	Triclopyr
alder	S-I	S	S	S	S	S
arborvitae	R	R	S		S	
ash	R	S-I	I-R	S-I	I-R	S
barberry, common	I	S		S	S-I	
basswood	R	S	S	S	S	S
beech	R		I	S-I	S	S-I
birch	S	S	S		S	S
blackberry	R		I-R	S	S-I	S
black locust						S
blueberry	S	S	I-R	I	S	S-I
buckthorn	I-R		I-R		S	S
cedar	R	I-R	S		S	
cherry, black, red	S-I	S	S	S-I	S	S-I
cherry, choke	S-I	S	S	S	S	S
cranberry	S					
creeper, virginia	S	S-I	S	S-I	S	
currants, wild	R		S			
dogwood	S-I	S		S	S	S
elderberry	S		S-I		S	S
elm	I	S-I	S	S-I	S	S-I
fir, balsam	R	S-I	S		S	I-R
grape, wild	S	S	S		S	S
hardhack, spirea	I				S	
hawthorn	I-R	S	S-I	S	S	S
hemlock	R				S	
hickory, black, shagbark	R	S-I	S	I		S
honey locust						S-I
honeysuckle	S-I	S	S		S	
ironwood	R	S-I	S		S	S
juniper	R	I-R	S		S-I	
lilac	I-R				S	

Table 21. Susceptibility of Woody Plants to Various Herbicides and Mixtures as Foliage Spray

Common Name	2,4-D	2,4-D Dichlorprop (1:1)	2,4-D Dicamba (2:1)	Fosamine ammonium	2,4-D Picloram (3.7:1)	Triclopyr
locust, black	I				S	
Locust, honey	S-I					
maple, Manitoba	S-I	S	S	S-I	S	S
maple, red	R	I-R	I-R	S-I	S	S-I
maple, silver	S-I				S	S
maple, sugar	R	S-I	I-R		S	S
oak, red	I	I-R	S	I-R	S-I	S
oak, white	I	S-I	S-I		S-I	I
oak, bur	R-I		S	I-R	S	
pine	R	S-I	S	I-R	S	I
plum, wild	I	S		S		
poison-ivy	I	S-I	S	I	S	S
poplar, aspen	S	S	S		S	S
prickly-ash	R		S	S		S
raspberry, wild	R	S	I	S		S
redbud rhododendron	R				R	S
rose, wild	R	I	S	S	S	S
sassafras	S-I					S
sheep-laurel	I		S		S-I	S
spruce	R	I-R	S		S-I	R
sumac, poison	S					S
sweet-fern	I		S	S-I		
viburnum	R					S
walnut	S-I				S	
willow	S	S	S	S	S	S

S Susceptible. Adequate control obtained with one application.

I Intermediate. Retreatment is usually needed for adequate control.

R Resistant. Two or more applciations may not be adequate.

Active Ingredient TRADE NAME (Formulation)	RATE (active) PRODUCT PER HA	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Notes on Chemicals section)

Water Weeds (Aquatic Plants)

A Permit to Purchase and/or Perform a Water Extermination must be obtained before a pesticide, for control of aquatic weeds, can be legally purchased and/or applied to surface waters in Ontario (unless exempt).

An exemption from the permit requirement is made for "agriculturists" who wish to treat a water body wholly confined within their property and where there is no outflow, at any time, beyond their property limits.

For further information on licensing and permits, contact any Ontario Ministry of the Environment Regional Office.

Herbicides provide temporary control of nuisance aquatic vegetation. Alternate methods such as mechanical removal (Submergents), dredging or substrate alteration (drainage ditches) can provide longer term control. Management techniques for vegetation control in ponds include minimizing nutrient input, dredging excess sediment, logs and other organic debris, decreasing the surface to depth ratio and increasing the rate of pond turnover (flushing). Some aquatic plant and algae life should be accepted and tolerated as a vital component of a healthy ecosystem.

The use of herbicides may be complicated by the use of water by livestock or humans or by the presence of fish. If the water is flowing, the effect of the chemical on plant, animal, or fish life downstream must be considered. Flowing water, by diluting the herbicide, makes control less effective.

The vegetation also varies widely; species include completely submerged ones such as Elodea (Elodea, Canada waterweed) and algae; free floating ones such as water lilies and emergent plants. Many emergents will grow equally as well on the moist shoreline as when their lower stems and roots are in water. Where these emergent species have taken possession of the shoreline, control measures must embrace that area as well as the water.

Chara (Chara stonewort, muskgrass) are a gray green to green plant-like algae, attached to the sediment, or free floating which in dense communities has a very strong musk odour. It is brittle to the touch and will dry to a white powder upon removal from the water. This plant is difficult to control with moderate doses of algaecides and dense communities should be removed mechanically.

Tapegrass (wild celery) (Vallisneria americana); found in many recreational lakes, is resistant to all the currently recommended herbicides. It has long rubbery leaves and numerous short roots. Control is possible only by mechanical methods such as pulling.

Diquat (REGLONE A) provides good control of a wide variety of submergent species including water-milfoil, pondweeds Elodea(Elodea Canada waterweed) and coontail. This herbicide is not effective against chara stonewort muskgrass (Chara spp). Diquat should be applied on cloudy days in late afternoon and care should be taken not to stir up the bottom since turbidity reduces the effectiveness of treatment. Since diquat takes effect rapidly, decomposition of a large plant mass may deplete oxygen levels which can cause fish to suffocate. Thus, in ponds where fish are present and growth is well established, no more than 1/4 to 1/2 of the pond should be treated at one time. Wait two weeks before treating again. The best time to apply these chemicals is late spring while the plants are growing rapidly. Since this is a contact chemical, control is achieved for one season, and repeat treatments must be made annually.

Emergent species such as cattails and bulrushes may have to be sprayed for 2 or 3 consecutive years to bring them under complete control. The chemicals for cattails and other emergents are sprayed so as to thoroughly wet all exposed foliage. Paraquat and amitrole are most effective when cattails are coming into head. Consult the manufacturer's directions.

Use of copper based algaecides may be toxic to trout or other fish. To avoid suffocation of fish due to oxygen depletion from decaying vegetation treat ponds in sections and observe recommended time periods between partial treatments. Copper algaecides may be used only in ponds where water is wholly confined within the property of the user and where there is no outflow beyond the property limits at any time.

copper ethanolamine CUTRINE PLUS (9 Li)	0.17 kg/1000m3 1.89 L/1000m3 0.5 m - use 9.21 L/ha 1 m - use 18.42 L/ha 1.5 m - use 27.63 L/ha	 0.5 m - use 3.68 L/ac 1 m - use 7.37 L/ac 1.5 m - use 11.05 L/ac	Filamentous algae, pond scums. Use only in water where there is no discharge from the property. Not for use in potable waters. No restrictions on fishing or swimming. Care should be taken if fish are present. When algae are dense make 3 partial treatments; observe 7-14 day waiting period between treatments. Dilute the product 1 to 9 with water before applying. Fish caution: CUTRINE PLUS is toxic to fish - extremely toxic in water of low hardness. Where water hardness is unknown do not use if fish are present.
copper ethanolamine CUTRINE PLUS (9 Li)	0.32 kg/1000m3 0.5 m - use 18.42 L/ha 1 m - use 36.84 L/ha 1.5 m - use 55.26 L/ha	 0.5 m - use 7.37 L/ac 1 m - use 14.74 L/ac 1.5 m - use 22.1 L/ac	Chara and Nitella spp. in ponds. For use in ponds wholly confined within the user's property and where there is no outflow beyond the property limits at any time. In hard water CUTRINE PLUS is toxic to fish if 0.4 ppm is exceeded. If fish are present but water hardness is not known, do not use CUTRINE PLUS. Split treatments at 7-14 day intervals are recommended to avoid oxygen depletion where plant mass is dense. Dilute product 1 to 9 with water before applying. Also see CAUTION at start of section.
diquat(aquatic) REGLONE A (200g/L)	4.4 to 7 kg/ha 22 to 35 L/ha	 8.8 to 14 L/ac	Mixed submerged vascular plants in ponds, ditches, lakes, river canals, slow moving or still water. DO NOT use treated water for animal consumption or swimming for at least 24 hours. DO NOT use for human consumption or irrigation for at least 5 days. To avoid oxygen depletion, treat only 1/4 to 1/3 of the area at a time. Apply at dusk in mid to late June when plants are young and growing vigorously. Tape grass and Chara are NOT controlled.
diquat(aquatic) REGLONE A (200g/L)	2.2 kg/ha 11 L/ha	 4.4 L/ac	Eurasian water milfoil in lakes. Treat when plants are in the very early stage of growth (June). See diquat note above.
water soluble dyes AQUASHADE (26 Li)	195 mL/1000m3 750 mL/1000m3		Filamentous algae, pond scums. For use in ponds with no outflow. DO NOT apply to water that will be used for drinking or other domestic purposes. Make application early in the growing season before algae and weed growth develop. Re-apply when the colour of water fades or first new algae growth develops. Mechanically remove any heavy vegetation before applying AQUASHADE to avoid oxygen depletion and fish suffocation.
amitrole AMITROL 240 (231g/L)	9 to 11 kg/ha 37.5 to 45.75 L/ha	 15 to 18.3 L/ac	Cattails in non crop areas (roadsides, fencerows, ditch banks, drainage ditches). Apply after catkins are fully formed and up to frost. DO NOT disturb sprayed plant. DO NOT apply where water will be used for irrigation, drinking or other domestic uses. DO NOT apply where water is not wholly confined to users property. Apply at a spray volume of 1000 L/ha (400 L/ac) water.
diquat(aquatic) REGLONE A (200g/L)	2.2 to 6.4 kg/ha 11 to 32 L/ha	 4.4 to 12.8 L/ac	Duckweed. Apply by directed surface spray on foliage. Use in 1700-2200 L/ha (680-880 L/ac) water. See REMARKS on previous page.
paraquat GRAMOXONE (200g/L)	1.1 to 2.2 kg/ha 5.5 to 11 L/ha	 2.2 to 4.4 L/ac	Cattails, bulrushes and emerged grasses. DO NOT use treated water for 7 days for swimming, human or animal consumption. DO NOT use for irrigation for 5 days. DO NOT apply to muddy water or agitate water excessively for 1-2 days after treatment. Treat cattails and bulrushes when plants are in flower. Avoid inhalation of spray mist; consult label for appropriate protective clothing. Apply at a spray volume of 850-1000 L/ha (340-400 L/ac) water.

Table 22. Habitats and Herbicide Susceptibility of Common Aquatic Plants

	spring-fed pond	dugout	soft water lake*	hard water lake**	wet ditch***	dry ditch****	Mechanical Control	Copper compound (1)	Diquat (2)	Paraquat (3)	Amitrole (4)
Algae											
Spirogyra spp.	VC	VC	C-I		VC	I		S	R		
Ulothrix spp.	C	VC			VC			S	R		
Mougeotia spp.	C	VC			VC			S	R		
Cladophora spp.	VC	VC	C	VC	VC	VC		S	R		
Chara spp. (Muskgrass)	VC	I	C-I	VC-I	VC	R		S	R		
Nitella spp. (Stonewort)	I	R	VC	R	R	R		S	R		
Submergent Macrophytes											
Sago pondweed (P. pectinatus)	I	C-I		VC				R	S		
Curly-leaf pondweed (P.crispus)	C	VC		VC				R	S		
Bassweed (P.amplifolius)	R	C		C				R	I		
Richardson pondweed (P. richardsonii)				VC-C				R	S-I		
Flat-stemmed pondweed (P. zosteriformis)				C				R	S		
other narrow-leaf pondweed (Potamogeton spp.)	I	C	C	VC-C				R	S		
Eurasian water milfoil (Myriophyllum spicatum)			VC					R	VS		
Native milfoil (M. exalbescens and others)	C		C	VC				R	VS		
Bladderwort (Utricularia vulgaris)		C		C				R	S-I		
Coontail (Ceratophyllum demersum)		C		VC				R	I		
Water stargrass (Heterantheria dubia)				C				R	S-I		
Tape grass (Vallisneria americana)	R	I	C	VC	R	R	M**	R	R	R	R
Water naiad (Najas flexilis)		I		VC				R	S		
Canada water weed (Elodea canadensis)		C		VC				R	I		
Emergents											
Cattails (T. latifolia, T angustifolia)	VC	VC		VC	VC	I-C	M	R	R	I	S-I
Bulrush (Scirpus spp.)			C	VC	C	C	M	R			S-I
Sedge (Carex spp+A42.)			C	C	C	VC	M	R			S-I
Bur reed (Sparganium spp.)	C		C	C	C	VC	M	R			I
Water plantain (Alisma spp.)			I	C	C	VC		R			S
Pipewort (Eriocaulon spp.)	R	R	C	R	R	R	M*	R		S	
Arrowhead (Sagittaria spp.)		C		VC	I-C			R		S	
Pickerelweed (Pontederia spp.)			VC		I	R		R		S-I	
Water smartweed (Polygonium amphibium)	I	I						R		S-I	

Table 22. Habitats and Herbicide Susceptibility of Common Aquatic Plants

	spring-fed pond	dugout	soft water lake*	hard water lake**	wet ditch***	dry ditch****	Mechanical Control	Copper compound (1)	Diquat (2)	Paraquat (3)	Amitrole (4)
Water shield (Brasenia spp.)			C					R		S-I	
White water lily (Nymphaea spp.)			C	C			M*	R		I	
Yellow water lily (Nuphar spp.)		C-I	C	C			M*	R		I	
Duckweed (Lemna spp.)	R	C	I-R	VC				R	S	S	
Duckmeal (Wolffia spp.)	R	C-I	I-R	VC				R	S	S	

VC - very common, C - common, I - infrequent, R - rare

M - manual or mechanical methods equally as effective as herbicides

M* - manual or mechanical methods are generally more effective than herbicides

M** - manual or mechanical methods are the only control measure currently available

S - susceptible, I - Intemediate, R - resistant

Bur reed is also very common as a submerged plant in ecotypes C and D

* A typical Muskoka lake is an example of a soft water lake

** A typical Kawartha lake is an example of a hard water lake

*** A wet ditch contains water at time of treatment

**** A dry ditch contains no water at time of treatment

1 - Copper compound (Cutrine Plus)

2 - Diquat (Reglone A)

3 - Paraquat (Gramoxone)

4 - Amitrole (Amitrole 240)

Table 23. Classification of Weeds According To Response to Various Foliage Sprays

	2,4-D				
aster (perennial)	I				
bedstraw (perennial)	R	I-R	R	I	R
bellflower (perennial)	R				
bindweed, field (perennial)	I	I	I	I	S-I
blueweed (biennial)	S-I	I		I	I
bracken fern (perennial)	R	R	R	R	I
buckwheat, wild (annual)	I-R	I	I-R	I-R	S
burdock (biennial)	S	S	I		S
buttercup (perennial)	I-R	S-I	I**(I-R)	I	I
campion, bladder (perennial)	R	R	R	R	
carrot, wild (biennial)	S-R	S-R	R	I-R	S
catchfly, night-flowering (annual)	R	R	R	R	
catnip (perennial)	S-I				
chickweed, common (annual)	I-R	I	R	S	S
chickweed, mouse-eared (perennial)	I-R	I-R	R	S	S
chicory (perennial)	S	S-I	S-I*(R)	I-R	S
cinquefoil, rough (winter annual)	I				
cinquefoil, sulphur (upright c.), (perennial)	I				
cocklebur (annual)	S	S	S	S	S
cockle, purple (annual)	I-R	R	R		I
cockle, white (perennial)	R		I-R		I
daisy, ox-eye (perennial)	I	I	R	I	I
dandelion (perennial)	S	S	I*(R)	I	S
dock (perennial)	I	I	I	I	
evening-primrose (biennial)	S				
false flax (winter annual)	S	S	S	S	S
fleabane, annual (daisy f.) (winter annual)	I	I	S-I		
fleabane, Canada (annual)	S-I				
goat's-beard (biennial)	I				
golden rod (perennial)	I	R	I	I	
goosefoot (annual)	S	S	S	S	
goutweed (perennial)	R	R	R	R	
grasses (annual and perennial)	R	R	R	R	
ground-ivy (Creeping Charlie) (perennial)	I-R	I-R		I	S

Table 23. Classification of Weeds According To Response to Various Foliage Sprays

Common Name	2,4-D	P	MCPA	2,4-DB or MCPB	Mecoprop	Dicamba
groundsel (annual)	I	I			
hawkweed (perennial)	I-R	I-R			S-I
heal-all (perennial)	I-R	I-R	I-R	S	S
hemp-nettle (annual)	R	S-I	I-R**(R)	R	
horse-nettle (perennial)	R				I
horse-tail (perennial)	I-R	S-I	I-R	I-R	I
knapweeds (perennial)	R		I*(I-R)		I
knotweed (annual)	I-R		I-R*(R)	S-I	S
lady's thumb (annual)	S-I	I-R	S	I-R	S
lamb's-quarters (annual)	S	S	S	S	S
lettuce, prickly (annual)	S-I	S	I-R	S	
mallow, round-leaved (perennial)	I-R	I-R	R	I-R	
mayweed (annual)	I-R		I		S
medick, black (winter annual)	I	I		S	I
milkweed (perennial)	R	R	R	I-R	I-R
motherwort (perennial)	S-I				
mullein (biennial)	I-R				
mustards (annual)	S	S	I	S	
nightshade (perennial)	I-R			R	
parsnip, wild (biennial)	S				
pepper-grass, common (winter annual)	S	S-I	I		
pepper-grass, field (winter annual)	S	S	I		
pigweeds (annual)	S	I	S-I	S	S
pineappleweed (annual)	S		R	R	
plantains (perennial)	S	S	S-I	S-I	I
purslane (annual)	I	I	S-I	S-I	
ragweed (annual)	S	S	S	S	S
ragwort (biennial and perennial)	I-R	R	R	I	S-I
ribgrass (see plantains) (perennial)					
rocket, yellow (biennial)	S	I	I*(R)		
shepherd's purse (winter annual)	S-I	S	S-I	S-I	
smartweed, green (annual)	S-I	I-R	I-R	I-R	S
sorel, sheep (perennial)	I	R			
sow-thistle, annual (annual)	S	I	S-I	I	S-I

Table 23. Classification of Weeds According To Response to Various Foliage Sprays

Common Name	2,4-D	MCPA	2,4-DB or MCPB	Mecoprop	Dicamba
sow-thistle, perennial (perennial)	I	R	S-I*(I-R)		S-I
speedwells (annual and perennial)	I-R	I-R		S-I	I
spurge, cypress (perennial)	I-R	I-R	I-R		I
spurge, leafy (perennial)	I-R	I-R	I-R	R	S
spurry, corn (annual)	R	I	R	I	R
St. John's wort (perennial)	R	R	R	R	S
stinkweed (pennycress) (winter annual)	S	S	S-I	S-I	
stonecrop, mossy (perennial)	I	I		S-I	
teasel (biennial)	S				
thistle, bull (biennial)	S	S	S	S	S-I
thistle, Canada (perennial)	I	I	I	I	
thistle, nodding (biennial)	I		I		S-I
thistle, Russian (annual)	S-I		I-R	R	
toadflax (perennial)	R	R	R	R	S-I
velvetleaf (annual)	S-I	I	S-I*(I-R)		I
vetch (perennial)	I-R	I-R	R	I-R	I
vetches, wild (annual)	S	S			
violet, field (field pansy) (annual)	R			R	
water-hemlock (perennial)	S-I				
wood-sorrel (perennial)	I-R				
yarrow (perennial)	R	I-R		I-R	I-R

* 2,4-DB more effective (susceptibility to MCPB in brackets)

** MCPB more effective (susceptibility to 2,4-DB in brackets)

S - Susceptible. Killed by 1 application of 2,4-D, MCPA or Mecoprop (1.2 kg or less per hectare); or by 1 application of dicamba (425 g or less per hectare).

I - Intermediate. Killed less rapidly but controlled by higher rates or by repeated applications.

R - Resistant. Not affected or only slightly damaged by chemical treatment. Control of this weed is not practical with herbicide(s) listed at the top of this column.

Ontario Ministry of the Environment Pesticide Control Offices

REGION County	PESTICIDES OFFICER Address	Telephone
Central Region Toronto, Halton, Peel York, Durham	**Charles Zubovits** 5775 Yonge St, 8th Floor Toronto, Ontario M2M 4J1	(416) 326-3671 Toll Free 1-800-810-8048 Fax (416) 325-6347
West-Central Region Haldimand-Norfolk, Niagara, Hamilton-Wentworth, Dufferin, Wellington, Waterloo, Brant	**Paul McCubbin** **Linda Gabriele** Ontario Government Building 119 King St. West, 12th Floor Hamilton, Ontario L8P 3Y9	(905) 521-7667 (905) 521-7658 Fax (905) 521-7820
Eastern Region Frontenac, Hastings, Lennox & Addington, Prince Edward, Leeds & Grenville, Prescott & Russell, Stormont/Dundas & Glengarry Peterborough, Victoria, Northumberland, Renfrew, Ottawa-Carleton, Lanark, District of Nipissing (Twsps of Airy, Murchison, Dickens, Lyell and Sabine)	**Andrew Morley** 133 Dalton Avenue P.O. Box 820 Kingston, Ontario K7L 4X6	(613) 549-4000 ext 2684 Fax (613) 548-6908 Toll Free 1-800-267-0974
Southwestern Region Elgin, Middlesex, Oxford, Essex, Kent, Lambton, Bruce, Grey, Huron, Perth,Simcoe	**Doug Morrow** **Wray Lampman** 659 Exeter Road, 2nd Floor London, Ontario N6E 1L3	(519) 873-5047 (519) 873-5048 Fax (519) 873-5000
Northern Region Manitoulin, Nipissing, Parry Sound, Sudbury, Algoma East, Cochrane East, Haliburton, Muskoka	**Ray Potvin** John Negusanti 199 Larch Street, Ste 1101 Sudbury, Ontario P3E 5P9	(705) 564-3247 (705) 564-3249 Fax (705) 564-4180
Kenora, Rainy River, Thunder Bay, Algoma West, Cochrane West		
Standards Development Branch	Pesticides Section (Mailing Address) 135 St. Clair Avenue West Toronto, Ontario M4V 1P5	(416) 327-5519 Fax (416) 327-2936
Approvals Branch	Pesticides Licensing 250 Davisville Avenue, 3rd Floor Toronto, Ontario M4S 1H2	(416) 440-3584 Toll Free 1-800-461-6290 Fax (416) 440-6973

UNIVERSITY OF GUELPH

Main Campus, Guelph, N1G 2W1 (519) 824-4120
Alfred College, Alfred, K0B 1A0, (613) 679-2218
Kemptville College, Kemptville, K0G 1J0, (613) 258-8336
Ridgetown College, Ridgetown, N0P 2C0, (519) 674-1500

Horticultural Research Institute of Ontario

Muck Research Station, 1125 Woodchopper's Lane, R.R. # 1, Kettleby, L0G 1J0, (905) 775-3783
Horticulture Experiment Station: Box 587 Blue Line Rd., Simcoe, N3Y 4N5, (519) 426-7127
Box 7000, 4890 Victoria Ave. N., Vineland Station, L0R 2E0, (905) 562-4141

Lab Services Division

Pesticide and Trace Contaminants, P.O.Box 3650, 95 Stone Road, West, Guelph, N1H 8J7, (519) 767-6200
Pest Diagnostic Clinic (519) 767-6256

AGRICULTURE & AGRI-FOOD CANADA

Research Centres

Eastern Cereals and Oilseeds Research Centre, 960, Carling Avenue, Ottawa, K1A 0C6 (613) 759-1952
Greenhouse and Processing Crops Centre, Harrow N0R 1G0, (519) 738-2251
Southern Crop Protection and Food Research Centre
- 1391 Sandford St., London N5V 4T3 (519) 457-1470
- Vineland Research Farm - 4902 Victoria Ave. N., Vineland (905) 562-4113
- Delhi Research Farm - Box 186 Schafer Rd., Delhi N4B 2W9 (519) 582-1950

CANADIAN FOOD INSPECTION AGENCY

Regional Offices (Plant Protection)

Belleville - 345 College Street East, Belleville, K8N 5S7, (613) 969-3333
Hamilton - 709 Main St. W. 101, Hamilton, L8S 1A2 (905) 572-4152
London - 457 Richmond St., Suite 404, London, N6A 3E3 (519) 645-4021
Niagara Falls - (Mail address) P.O. Box 35, Niagara Falls, L2E 6S8
(Street address) 4551 Zimmerman Ave., Niagara Falls, L2E 3M5, (905) 357-5981
Ottawa District - 3 Observatory Crescent, Bldg., #3 Central, Experimental Farm, Ottawa, K1A 0C9, (613) 759-1571
Toronto Office - 401 Champagne Drive, Unit 1, Downsview, M3J 2C6, (416) 954-1714
Windsor - 441 University Ave. W., Suite 208, Windsor, Ont. N9A 5P9 (519) 252-7095

The Metric System

Linear Measures (length)

10 millimetres (mm)	= 1 centimetre (cm)
100 centimetres (cm)	= 1 metre (m)
1000 metres	= 1 kilometre (km)

Square Measures (area)

100 m X 100 m = 10,000 m^2	= 1 hectare (ha)
100 ha	= 1 square kilometre (km^2)

Cubic Measures (volume)

Dry Measures

1000 cubic millimetres (mm^3)	= 1 cubic centimetre (cm^3)
1,000,000 cm^3	= 1 cubic metre (m^3)

Liquid Measures

1000 millilitres (mL)	= 1 litre (L)
100 L	= 1 hectolitre (hL)

Weight-Volume Equivalents (for water)

(1.00 kg) 1000 grams	= 1 litre (1.00 L)
(0.50 kg) 500 g	= 500 mL (0.50 L)
(0.10 kg) 100 g	= 100 mL (0.10 L)
(0.01 kg) 10 g	= 10 mL (0.01 L)
(0.001 kg) 1 g	= 1 mL (0.001 L)

Weight Measures

1000 milligrams (mg)	= 1 gram (g)
1000 g	= 1 kilogram (kg)
1000 kg	= 1 tonne (t)
1 mg/kg	= 1 part per million (ppm)

Dry – Liquid Equivalents

1 cm^3	= 1 mL
1 m^3	= 1000 L

Metric to Imperial (Approximate)

litres per hectare x 0.09	= gallons per acre
litres per hectare x 0.36	= quarts per acre
litres per hectare x 0.71	= pints per acre
millilitres per hectare x 0.015	= fluid ounces per acre
grams per hectare x 0.015	= ounces per acre
kilograms per hectare x 0.89	= pounds per acre
tonnes per hectare x 0.45	= tons per acre

Imperial to Metric (Approximate)

gallons per acre x 11.23	= litres per hectare (L/ha)
quarts per acre x 2.8	= litres per hectare (L/ha)
pints per acre x 1.4	= litres per hectare (L/ha)
fluid ounces per acre x 70	= millitres per hectare (mL/ha)
tons per acre x 2.24	= tonnes per hectare (t/ha)
pounds per acre x 1.12	= kilograms per hectare (kg/ha)
ounces per acre x 70	= grams per hectare (g/ha)

Calculating Parts per million (ppm)
1 ppm = 1 g active ingredient per 1000 L water

Application Rate Conversions

Dry Weight Equivalents

Grams or Kilograms per Hectare	*Ounces or Pounds per Acre*
100 grams	= 1 1/2 ounces
200 grams	= 3 ounces
300 grams	= 4 1/4 ounces
500 grams	= 7 ounces
700 grams	= 10 ounces
1.10 kilograms	= 1 pound
1.50 kilograms	= 1 1/4 pounds
2.00 kilograms	= 1 3/4 pounds
2.50 kilograms	= 2 1/4 pounds
3.25 kilograms	= 3 pounds
4.00 kilograms	= 3 1/2 pounds
5.00 kilograms	= 4 1/2 pounds
6.00 kilograms	= 5 1/4 pounds
7.50 kilograms	= 6 3/4 pounds
9.00 kilograms	= 8 pounds
11.00 kilograms	= 10 pounds
13.00 kilograms	= 11 1/2 pounds

Metric Conversions

5 mL	=1 tsp
15 mL	= 1 tbsp
28.5 mL	= 1 fl. oz.

Liquid Equivalents

Litres/ Hectare	*Approximate Gallons/Acre*
50 =	5
100	= 10
150	= 15
200	= 20
250	= 25
300	= 30

Handy Metric Conversion Factor
Litres per hectare x 0.4 = [illegible]
Kilograms per hectare x 0.4 = [illegible]

CONVERSION TABLES — Metric to Imperial

Length

1 millimetre (mm)	= 0.04 inch
1 centimetre (cm)	= 0.40 inch
1 metre (m)	= 39.40 inches
1 metre (m)	= 3.28 feet
1 metre (m)	= 1.09 yards
1 kilometre (km)	= 0.62 mile

Volume (liquid)

1 millilitre (mL)	= 0.035 fluid ounce
1 litre (L)	= 1.76 pints
1 litre (L)	= 0.88 quart
1 litre (L)	= 0.22 gallon (Imp.)
1 litre (L)	= 0.26 gallon (U.S.)

Weight

1 gram (g)	= 0.035 ounce
1 kilogram (kg)	= 2.21 pounds
1 tonne (t)	= 1.10 short tons
1 tonne (t)	= 2205 pounds

Pressure

1 kilopascal (kPa)	= 0.15 pounds/in^2

Area

1 square centimetre (cm^2)	= 0.16 square inch
1 square metre (m^2)	= 10.77 square feet
1 square metre (m^2)	= 1.20 square yards
1 square kilometre (km^2)	= 0.39 square mile
1 hectare (ha)	= 107,636 square feet
1 hectare (ha)	= 2.5 acres

Volume (dry)

1 cubic centimetre (cm^3)	= 0.061 cubic inch
1 cubic metre (m^3)	= 1.31 cubic yards
1 cubic metre (m^3)	= 35.31 cubic feet
1000 cubic metres (m^3)	= 0.81 acre-foot
1 hectolitre (hL)	= 2.8 bushels

Speed

1 metre per second	= 3.28 feet per second
1 metre per second	= 2.24 miles per hour
1 kilometre per hour	= 0.62 mile per hour

Temperature

°F = (°C X 9/5) + 32

CONVERSION TABLES — Imperial to Metric

Length

inch	= 2.54 cm
foot	= 0.30 m
yard	**= 0.91 m**
mile	= 1.61 km

Area

square foot	= 0.09 m^2
square yard	= 0.84 m^2
acre	= 0.40 ha

Weight

ounce	= 28.35 g
pound	= 453.6 g
ton	= 0.91 tonne

Volume (dry)

cubic yard	=0.76 m^3
bushel	= 36.37 L

Volume (liquid)

fluid ounce (Imp.)	= 28.41 mL
pint (Imp.)	= 0.57 L
gallon (Imp.)	= 4.55 L
gallon (U.S.)	= 3.79 L

Pressure

pound per square inch	= 6.90 kPa

Temperature

°C = (°F - 32) x 5/9

ABBREVIATIONS

%	= per cent (by weight)
ai	= active ingredient
AP	= agricultural powder
cm	= centimetre
cm^2	= square centimetre
DG	= dispersible granular
DP	= dispersible powder
E	= emulsifiable
e.g.	= for example
EC	= emulsifiable concentrate
F	= flowable
g	= gram
Gr	= granules, granular
ha	= hectare
kg	= kilogram
km	= kilometre
km/h	= kilometres per hour
kPa	= kilopascal
L	= litre
m	= metre
m/s	= metres per second
m^2	= square metre
mL	= millilitre
mm	= millimetre
SC	= sprayable concentrate
SP	= soluble powder
t	= tonne
W	= wettable (powder)
WDG	= water dispersible granular
WP	= wettable powde

Spraying Application Record

Application Equipment Used:

Tank Capacity:	Nozzle Type & Pressure:	Comments:

Tractor Speed or Gear and RPM:

Calibrated Application Rate per hectare or acre:

Application Information							Environment Information		
Product Used & Location & Size	Application Date & Time	Crop & Stage of Growth	Product Concentration	Product rate per hectare or acre	Water rate per hectare or acre	Number of Tanks per field	Wind Speed & Direction	Temperature	Soil Moisture

Spraying Application Record

Application Equipment Used:

Tank Capacity:	Nozzle Type & Pressure:	Comments:

Tractor Speed or Gear and RPM:

Calibrated Application Rate per hectare or acre:

Application Information							Environment Information		
Field Identification Location & Size	Application Date & Time	Crop & Stage of Growth	Product (concentration)	Product (rate ha or acre)	Water (rate ha or acre)	No. of Tanks (per field)	Wind Speed & Direction	Temperature	Soil Moisture

Spraying Application Record

Application Equipment Used:

Tank Capacity:	Nozzle Type & Pressure:	Comments:

Tractor Speed or Gear and RPM:

Calibrated Application Rate per hectare or acre:

Application Information							Environment Information		
Field Identification, Location & Size	Application Date & Time	Crop & Stage of Growth	Product Concentration	Product Rate /ha or /ac	Water Rate /ha or /ac	No. of Tanks per field	Wind Speed & Direction	Temperature	Soil Moisture

Spraying Application Record

Application Equipment Used:

Tank Capacity:	Nozzle Type & Pressure:	Comments:

Tractor Speed or Gear and RPM:

Calibrated Application Rate per hectare or acre:

Application Information							Environment Information		
Field Identification & Site	Application Date & Time	Crop & Stage of Growth	Product Concentration	Product Rate kg per acre	Water Rate L per acre	Number of Tanks per Field	Wind Speed & Direction	Temperature	Spray Mix Ph

Spraying Application Record

Application Equipment Used:

Tank Capacity:	Nozzle Type & Pressure:	Comments:

Tractor Speed or Gear and RPM:

Calibrated Application Rate per hectare or acre:

Application Information							Environment Information		
Field Identification, Location & Size	Application Date & Time	Crop & Stage of Growth	Product Concentration	Product Rate /ha or /acre	Water Rate /ha or /acre	No. of Tanks per field	Wind Speed & Direction	Temperature	Soil Moisture

Spraying Application Record

Application Equipment Used:

Tank Capacity:	Nozzle Type & Pressure:	Comments:

Tractor Speed or Gear and RPM:

Calibrated Application Rate per hectare or acre:

Application Information							Environment Information		
Field Number & Location & Size	Application Date & Time	Crop & Stage at Growth	Product & Concentration	Product Rate per hectare or acre	Water Rate per hectare or acre	Total Tanks per Field	Wind Speed & Direction	Temperature	Soil Moisture

Spraying Application Record

Application Equipment Used:

Tank Capacity:	Nozzle Type & Pressure:	Comments:

Tractor Speed or Gear and RPM:

Calibrated Application Rate per hectare or acre:

Application Information							Environment Information		
Field Identification Location & Size	Application Date & Time	Crop & Stage of Growth	Product Concentration	Product Rate ha or acre	Water Rate ha or acre	No. of Tanks per field	Wind Speed & Direction	Temperature	Soil Moisture

Spraying Application Record

Application Equipment Used:

Tank Capacity:	Nozzle Type & Pressure:	Comments:

Tractor Speed or Gear and RPM:

Calibrated Application Rate per hectare or acre:

Application Information							Environment Information		

Spraying Application Record

Application Equipment Used:

Tank Capacity:	Nozzle Type & Pressure:	Comments:

Tractor Speed or Gear and RPM:

Calibrated Application Rate per hectare or acre:

Application Information							Environment Information		
Field Location & Size	Application Date & Time	Crop & Stage	Product	Product Rate	Water Rate	Total Tanks per Field	Wind Speed & Direction	Temperature	Soil Moisture

HERBICIDE COMPANIES AND AGENTS

CODE	NAME	PHONE	WEB PAGE
*	Various manufacturers		
APB	APPLIED BIOCHEMISTS INC.	1-800-558-5106	www.appliedbiochemists.com/
ARV	AGREVO CANADA INC.	1-800-667-5959	www.ca.agrevo.com/
ATC	ICI SURFACTANTS	1-519-756-6181	www.surfactant.com/
BAT	BARTLETT, N.M. INC.	1-905-563-8261	
BAZ	BASF CANADA INC.	1-800-565-9586	www.basf.com/businesses/consumer/agproducts/
BBB	BAYER INC.	1-800-268-1331	www.bayer.ca/
CAU	CHEMINOVA CANADA	1-888-316-6260	www.cheminova.com/
CYC	CYANAMID CROP PROTECTION	1-800-263-1228	www.farmlinepartners.com/
DCS	DOW CORNING	1-800-663-4300	www.dowcorning.com/
DUQ	DUPONT CANADA INC.	1-800-667-3925	www.dupont.ca/ag/
DWE	DOW AGROSCIENCES CANADA INC.	1-800-667-3852	www.dowagro.com/canada/
EFA	ELF ATOCHEM of CANADA LTD.	1-905-827-9841	www.elf-atochem.com/newelf/homepage.cfm
GRC	GREAT LAKES CHEMICAL CORPORATION		www.greatlakescorp.com/
GRN	GRIFFIN CORP.	1-912-242-8635	www.griffinllc.com
INT	INTERPROVINCIAL COOPERATIVE LIMITED	1-204-233-3461	
MOL	MONSANTO CANADA INC.	1-800-667-4944	www.monsanto.com/
NLC	NALCO CANADA INC.	1-905-623-8791	www.nalco.com/
NOR	NORAC CONCEPTS INC.	1-613-841-2907	www.noracconcepts.com/
NOV	NOVARTIS CROP PROTECTION INC.	1-800-459-2422	www.cp.ca.novartis.com/
NUA	NUFARM AGRICULTURE INC.	1-800-868-5444	www.amitrol.com/
NUG	NU-GRO CORPORATION	1-519-456-2021	www.nugro.com/
PLG	PLANT PRODUCTS CO. LTD.	1-800-387-2449	www.plantprod.com/
RHQ	RHONE-POULENC CANADA INC.	1-800-891-8291	www.rp-ag.com/
ROH	ROHM & HAAS CANADA INC.	1-800-268-4201	www.rohmhaas.com/agcanada/
SAF	SANEX INC	1-905-602-5100	
SGF	SCOTTS CANADA LTD.	1-800-668-5669	www.scottslawn.com/
STD	STANCHEM INC.	1-416-259-8231	
SWC	SWIMCO CANADA INC.	1-905-873-2204	
UAG	UNITED AGRI PRODUCTS	1-800-265-4624	www.uap.ca/
UNR	UNIROYAL CHEMICAL	1-800-265-2157	www.uniroyalchemical.com/
VAR	VAN WATERS & ROGERS LTD.	1-800-265-7671	www.vwr-ltd.com/
WBR	WILBUR-ELLIS COMPANY OF CANADA LTD.	1-306-242-4553	www.wilburellis.com/
WIL	WILSON LABORATORIES INC.	1-905-639-7535	
ZNA	ZENECA AGRO	1-800-263-8308	www.zeneca.ca/
	ONTARIO PESTICIDES ADVISORY COMMITTEE	1-416-314-9233	www.opac.gov.on.ca/
	OMAFRA WEEDS PAGE		www.gov.on.ca/OMAFRA/english/crops/insects/weeds.html
	WEED SCIENCE SOCIETY of AMERICA		ext.agn.uiuc.edu/wssa/

Use Herbicides Safely

1. **Follow directions!** Read the instructions and follow precautions printed on the container labels.
2. **Protect the eyes** and avoid inhaling chemicals or prolonged exposure of the skin to chemical. Take special care when the herbicide is labelled "poisonous".
3. **Paraquat** - special care should be taken when handling paraquat (Gramoxone), especially the concentrate. Wear rubber or neoprene gloves, coveralls and eye shield. Prevent all contact with skin and eyes. Follow closely all precautions outlined on the product label. Do not apply through an air blast sprayer.
4. **2,4-D and related chemicals** may seriously damage crops of grapes, tomatoes, turnips, tobacco, beans, carrots, sugar beets, fruit trees, ornamental plants, and many others.
   a.) Spray only resistant crops. Before commencing, survey the area for the presence of desirable plants that might be damaged by the herbicide. There is a definite risk involved when spraying 2,4-D within 400 metres of a susceptible crop. However, if care is taken, areas closer than this may be sprayed under favorable conditions.
   b.) Spray on calm days or when there is a light breeze, away from the susceptible crop, and use as low a pressure as possible to reduce drift of the chemical. Use at least 100 L spray solution per hectare.
   c.) Use an amine formulation whenever possible to reduce vapor drift.
   d.) Use mechanical methods of weed and brush control where the spray risk is high.
   e.) Use a special sprayer for herbicides such as 2,4-D. Such chemicals are almost impossible to remove from a sprayer and traces of them in other solutions may damage susceptible plants.
5. Mixtures of different herbicides, or mixtures of herbicides with foliar fertilizers, insecticides, or fungicides should not be applied to crops in a single application unless recommended on the label.
6. Do not store herbicides near fungicides, insecticides, fertilizers, or other agricultural chemicals.
7. Apply herbicides properly, using the lowest recommended pressure.
8. **Avoid contamination of water supplies,** wells, ponds, streams, etc., when filling or flushing spray equipment, or when spraying. Never fill a sprayer directly from a well, pond or stream unless the unit is equipped with an anti-backflow device to prevent siphoning. Protect against spills.
9. **Rinse all empty metal, plastic, or glass** containers three times with water and add washings to the spray tank, or use a rinsing device. These rinsers can be used to puncture the bottom of a metal or plastic drum, and to rinse the residual left in the container directly into the spray tank. This procedure takes less than a minute and results in a rinsed container. The rinsed containers may be crushed, buried and covered by at least 50 cm of soil, away from any watercourse or water table at an appropriate landfill site.

Emergency and First-Aid Procedures for Pesticide Poisoning

- Become familiar with the chemicals you are using. Keep a list of common names in case of accidents or emergencies. This information can be found on the product labels and cross-referenced in this publication.
- If a pesticide has come in contact with the skin or has been spilled on clothing, remove the clothing and wash the skin thoroughly with soap and warm water.
- If pesticide has come in contact with the eyes, rinse them with plenty of clean water for 15 minutes. Repeat this procedure.
- If a person suspects poisoning from exposure to a pesticide by swallowing, inhalation, or contact with skin or eyes, read the label on the pesticide container and carry out the first-aid treatment suggested.
- **Immediately after first-aid treatment has been given, wrap the patient in a coat or blanket and rush him/her to the nearest hospital. Take the list of chemical common names with you and identify the ones being used.**
- **If a person is unconscious or lapses into unconsciousness, call an ambulance immediately.**
- **Emergency advice on pesticide poisoning is available from the Regional Poison Information Centres at: Toronto 1-800-268-9017 Ottawa (bilingual) 1-800-267-1373**
- **Those needing hearing assistance should call: 1-416-597-0215 (TTY) Emergency telephone numbers are listed at the front of each Bell telephone directory.**

Fill in the following:
My Local Poison Information Centre Telephone Number is:

_____ - _____

For information, or to obtain copies of this or any other ministry publication, please:
call 1-888-4-OMAFRA (1-888-466-2372) from within Ontario,
(519) 826-3700 from outside the province or
OMAFRA's TTY line at (519) 826-7402 for the hearing impaired,
email your request to *products@omafra.gov.on.ca*, or
visit OMAFRA's web site at *www.gov.on.ca/omafra*.

A complete listing of all OMAFRA products and services, and order forms, are available on the web site. Orders can be faxed to (519) 826-3633 or mailed to Government Information Centre, OMAFRA,1 Stone Road West, Guelph, ON N1G 4Y2